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Steel Trade Conditions

So much has been said recently about the iron and steel markets which is not based upon actual facts, and the stock exchanges have busied themselves so much with those markets—often on the basis of facts misstated or imperfectly understood—that some attempt to analyze present conditions will be of interest and perhaps of service. The iron trade in this country has always been subject to alternate waves of elation and depression; that it is not now in the trough of the wave, but is rather on the upward swell, is altogether probable.

Taking the production of pig iron as the basis of the industry, we find that the production for the eight months ended with August was 15,430,000 tons. Assuming that there will be no phenomenal increase of activity in the remaining four months of the year—and no such increase is in sight—the total make of pig iron in 1912 will probably be rather below than above 23,500,000 tons. This is 3,800,000 tons below that of 1910; but it is known that the great production of that year was above the requirements of the trade and that unsold or unused stocks increased during the year by something like 1,700,000 tons. While it is impossible to get exact figures on this point, such information as we have leads to the belief that nearly 1,000,000 tons of this surplus has been used up in one way and another. This would go far toward equalizing the production of the two years, so that the difference between them will actually be much less than appears from the face of the statistics. The weak point in the situation is that our blast furnaces can produce some 33,000,000 tons a year, even when allowance is made for the furnaces necessarily under repair; so that about 30 per cent. of the blast furnace capacity is at present idle. Between 65 and 70 per cent. of the pig iron is made by the furnaces owned or controlled by the steel companies, the remaining 30 per cent. coming from the merchant furnaces —that is, those which sell their product to consumers in the form of pig iron. It is the output of these furnaces upon which the quotations of pig iron in the markets are made. It will readily be seen that no material advance in these prices is possible as long as buyers are conscious of the existence of so large a number of furnaces, most of which are ready to take the first opportunity of ending an inactivity which is necessarily a heavy charge on the capital invested in their construction.

While pig iron is the base of the industry, it is the production and sales of finished steel and iron which are the final test. Fewer figures are attainable as to these; but from the statements of the Steel Corporation and others, it appears probable that the steel mills of the country are at present running up to about 75 per cent. of their production capacity, leaving about 25 per cent. idle. As with the blast furnaces, the inactive capacity is not only a tax on the capital invested, but it is also an assurance that no considerable advance in prices is possible. This has brought about in the market a condition which has been in evidence for something like a year past. The buyers —which class includes mainly those who use the iron and steel in the construction of buildings and in making the numberless forms of manufactured articles—feel secure against any sudden advance, and rather anticipate lower than higher prices. They have been, as a rule, buying only for their needs as they secured orders; making no long commitments and abstaining from speculation, because they have not believed in advances.

The idleness of 25 per cent. of our steel producing activity might be taken to indicate a seriously depressed condition of general business. It does so to a certain extent, but to a degree very much less than is usually supposed. The sales to the general trade, in the first place, have not decreased in as large a degree as the figures would indicate. In fact, the decrease is not great; new construction is quite active and the absorption of manu-

factured goods certainly increases with the growth of population. The present capacity for the production of finished steel is based upon the boom of 1905-07. In those years the railroads were large buyers of rails and all kinds of supplies, and of new equipment; but for two years past—from causes which cannot be discussed here—the railroads have been light buyers, postponing repairs and additions as long as possible. There has also been very little building of new lines. This would account for a large part of the apparent decrease in business. Moreover, there is another cause which is not generally taken into account, and that is that the extensions of plant, which were based on the boom, required large quantities of steel; and that source of demand has almost ceased for the present. That the extensions of capacity which were undertaken four or five years ago were rather overdone was inevitable; it was simply a repetition of former experience. It is going too far to say, as some have done, that such plants as those at Gary and Allequippa were financial and economic mistakes. They were simply a little ahead of time, and it will not be long before their full usefulness will be shown.

The course of prices in the iron and steel markets this year has been an interesting study. The controlled market, which was maintained with great effort and difficulty through the first part of the year, was broken when the Republic Iron and Steel Company in the latter part of May—for the second time in its history—announced its intention of pursuing "an aggressive course," and began to cut down prices on its products. This was followed, on June 1, by a general reduction in prices by the Steel Corporation. There was an effort to keep prices at the reduced levels, but it did not avail. For nearly two months past there has been so called shading on all sorts of products. That is, there has been practically an open market, which has resulted in a fair increase of business. It is understood that the Steel Corporation, as well as the independents, has played the game and has not turned away orders because of fractional differences in prices. Thus once more it is proved that a controlled market, easily maintained in times of active business and a surplus of orders, must inevitably give way when contrary conditions prevail. The law of supply and demand is not altogether obsolete, as some of our great financiers believe, or would try to persuade us to believe.

Upon the whole the steel trade is in sounder condition than Wall Street would have us think. There is a large business actually doing as a foundation, and the lower prices favor its growth. There is a general absence of speculation, and the underlying conditions are fairly sound. Overproduction is not general, and idle capacity will gradually be taken up, though another boom is not yet in sight. Operators must be content with lower profits for a time and there will be less surplus to put into new extensions; but this will not by any means be an unmixed evil.

Hydraulic Mining in British Columbia

In this issue of the JOURNAL a synopsis is given of the work that is being done on the extensive auriferous gravel deposits in the Cariboo district of British Columbia. The detrital and vein deposits of this region have been known for the last 50 years, but the latter evidently did not prove to be extensive or rich, and, for the former, there was not sufficient water for hydraulic mining.

From Mr. Jacob's article it appears that the water question was not one of quantity but of availability, and, that by large expenditures, the water from a large catchment area could be stored in reservoirs and used under sufficient effective head if full advantage were taken of the topography. Two large companies are now in the field and are rapidly completing the work of making reservoirs, dams, ditches, flumes and pipe lines.

A place for the disposition of the débris is the prime essential to hydraulic mining, and, of next importance, a large quantity of water under considerable head. The companies now about to begin operations own property well situated in regard to disposal of débris and have secured a quantity of water ample enough to carry on hydraulic operations for a great enough portion of the year to hold forth promise of the operations being profitable.

Hydraulic mining has had its day in most parts of the United States where extensive gravel deposits exist; not because the gravel was worked to the limit of the deposits, but because of the difficulty of the disposing of the débris without injury to property, especially farm land and rivers. The great deposits of the United States are in California, and except in three counties, hydraulic mining is restricted. The La Grange in Trinity county is probably the largest hydraulic mine now regularly operated in this country. When hydraulic mining was at its zenith in California, before the days of débris restrictions, the North Bloomfield mine, in Nevada county, was the most noteworthy operation and was visited by many engineers who desired to post themselves on this method of mining.

The gravel deposits of the Cariboo district resemble those at North Bloomfield, in that the gold appears to be concentrated in the lower strata. The Cariboo gravels are thick and, with the water supply established, a notable increase in the gold production by hydraulic mining would be effected. Probably the greatest profits will not be realized for some time until a large area of the deposits has been completely removed and the work of cleaning the bedrock is well advanced.

The Industrial Situation

During the last 10 weeks the quotations for securities in the markets of this country have experienced a radical decline, the causes for which are not yet thoroughly understood. It is evident, however, that they are broader than conditions affecting only our domestic affairs; for along with the slump in New York there have been similar events in London, Paris, Amsterdam and especially in Berlin. The economic factors producing this international upset may probably be traced back to the crisis of 1907, the damages of which have not yet been fully repaired.

Regarding recent events more narrowly, the decline in American securities has been caused by liquidation upon a non-receptive market. The liquidation, starting from domestic sources and then being taken up by London and Berlin, has not been phenomenally heavy, but in being undertaken upon a thin market has been of drastic effect. The causes precipitating our own liquidation seem to have been largely the impairment of confidence through the social and political tendencies of the day, while the same things, together with the consequences of

over-speculation, prompted liquidation from abroad. That our market has absorbed the securities returned to us so easily as it has is in itself a basis for optimism.

It is generally admitted that the financial position of the United States is sound and that there is still an immense buying power in reserve. That this has not yet displayed itself enthusiastically is ascribable to the fact that the most important class of securities—the railway—has not until recently, and perhaps not even yet, considering the probable effect of impending political and social tendencies, become very cheap; and while many of the industrial and mining securities have unquestionably become cheap any eager buying of them is not to be expected until general conditions become settled.

With respect to the purely industrial condition of this country, which is, of course, the basis to which everything else finally reverts, we are inclined to think that business has been gradually mending during the whole period of pessimistic turmoil in Wall Street, and that no recession, except perhaps very temporarily, is to be anticipated. Save for certain branches here and there reports agree fairly well that business is good and improving, but lacking in "snap." In other words, consumption is large, but producers are still carrying surplus supplies, arising from previous excesses in production, and middlemen have not yet gained the confidence to lead them to participate in shouldering the stocks. It seems to be certain that at the present time there are no stocks of staples in hands beyond those of the producers. This position of manufacturers will be a powerful factor upon the markets whenever confidence be regained.

The harvest of 1911 is not going to turn out so rich as was hoped a few months ago, but doubtless it will prove better than is now being forecast by bearish speculators, and probably we shall find eventually that we have gathered a very fair crop. The railway companies will probably be confronted by a diminution in net earnings, but the effect of this upon their own shares and upon industry in general has already been discounted. Some of the industrial companies may find themselves under the obligation to operate at a less margin of profit, but in general it seems to us that these have already experienced their full measure of trials and have but little to fear if consumption continues to increase. This is particularly true of the copper-mining companies, barring a noteworthy recession of business in Europe, and without doubt the recent decline in their shares in sympathy with the general market, has reduced some of them, particularly the "porphyries" to what are already real bargain prices.

The Course of Silver

The silver market during the present year has been characterized by a degree of monotony and uniformity of prices, which seems to be in part the result of the operations of the Bombay syndicate, the effects of which are still felt. Notwithstanding the large stocks which the syndicate held at the close of 1910, the buying by India this year has been large; China has been only a light purchaser and at times a seller, but the amounts were not large enough to affect the market. Apparently the syndicate has made no special efforts to market its stocks, though carrying them must have been a pretty heavy burden. Its hand, however, has been felt in the maintenance of prices, especially during the last month or two, during which there has been much uncertainty as to the outlook for the Indian crops. The buying this year has been altogether for private account; the Indian government has not been in the market, and its expected purchases for coinage have not been made. The Chinese currency reform drags, as such plans in China are apt to do, and has not yet reached the point where any considerable purchases of silver are required.

The exports of silver from London to the East, on which the market so largely depends, were as follows for the eight months ended with August:

	1910	1911	Changes
India.....	£ 4,197,500	£ 5,292,700	I. £1,095,200
China.....	1,113,500	949,700	D. 163,800
Total.....	£ 5,311,000	£ 6,242,400	I. £ 931,400
App. ounces..	52,284,350	61,367,950	I. 9,083,600

The approximate quantities are calculated at the average price in the London market for the eight months.

For the United States the figures for August are not available; but for the seven months ended with July the total exports of silver increased from $32,178,689 in value in 1910, to $39,718,211 in 1911; the increase in approximate quantities being from 60,867,250 oz. in 1910, to 74,930,100 oz. this year. A large part of these exports are of silver refined here from bullion received chiefly from Mexico, Central and South America. The net exports, which may be taken to represent shipments of silver produced in the United States, increased from $6,482,281—approximately 12,261,500 oz.—in 1910, to $13,836,816—or 26,103,750 oz.—this year. Silver from the United States usually constitutes from 75 to 80 per cent. of the total British imports. The proportion of American exports direct to China is very small.

The uniformity of the market is evident when we find that the average prices for the eight months in 1910 and 1911 differed only by 0.034d. in London and 0.140c. in New York. The highest monthly average in New York this year was 53.795c. in January, and the lowest 52.222c. in February; these extremes comparing with 51.453c. in March and 54.150c. in July last year.

Present conditions show no sign of an early change. Unless there should be a break, which is not now anticipated, it looks as if the current level of about 24d. in London and 52c. in New York might be maintained for some time.

The Lake Superior mines are not all dead yet, and Mr. Finlay doubtless had no intention of writing the obituary of the entire district, though one might think so from the garbled reviews of his report that have appeared in certain papers. In a recent interview Mr. Finlay remarks that the only seriously discouraging feature of the report is that there has been no new development to offset the exhaustion of properties on the Calumet lode. Of course, it was something of a shock to shareholders in some of the mines to learn that the value of the property represented by stock-exchange quotations could not be substantiated in assured or indicated ore. As we previously pointed out, a number of comparatively new mines have been developed in recent years, and promising prospecting is in progress in the district, and there is a large unprospected area that has excellent possibilities, so that the Lake Superior district will probably maintain a large copper production years after some of the present much-vaunted porphyry mines have been exhausted.

Metallics

By lowering the current density to 5 amp. per sq.ft., it has been found possible to use graphite anodes in the Clancy cyanide process. Fused magnetite anodes were originally considered necessary.

In brazing cast iron, clean the parts to be joined, heat to a bright red, and apply a flux made by mixing the following ingredients: Boric acid, 1 lb.; potassium chloride, pulverized, 4 oz.; and 3 oz. iron carbonate.

At the Victoria mine in the Lake Superior copper country, where there is one of the few air compressor plants of the Taylor type, every piece of machinery around the mine is operated either directly or indirectly with compressed air; the only places where heat is used are a stove for reheating a part of the air for the stamp head and in the blacksmith forge.

Instead of hatching those parts of a drawing showing sectional details, a correspondent suggests laying the tracing face down upon a sheet of ridged paper or cover of a book, then rubbing an indelible pencil over the back of the tracing cloth, bearing down quite hard. This will result in leaving lines on the tracing corresponding to the ridges, which serve well for section lines and take but a few minutes to put in.

A simple method of restoring overexposed blueprints consists in taking the print from the washing tanks and laying it face upward while still wet, on the table, then placing an unexposed dry piece of blueprint paper of the same size over the wet one, and rubbing it with a piece of cloth or with the hand. This brings the two surfaces into intimate contact, and when separated it will be found that the overexposed print is perfectly clear and of a rich blue color. The color obtained by this method is better than that obtained by the ordinary exposure and development, but there is, of course, the objection that a piece of blueprint paper is wasted for each print made.

Sometimes it is convenient to soft-solder iron and steel articles together, and this can be accomplished in the following manner: Remove the scale or any rust by immersing the articles in the solution, called a "pickle," made of eight parts water and one part sulphuric acid. Rinse in clear water and then clean in a solution of potash to remove any trace of grease. Make a solution of 4 oz. of copper carbonate and 12 oz. of potassium cyanide in 1 gal. of water. Electroplate the articles for a few minutes in this copper solution, after which they can be "tinned" with a soldering iron and then soldered securely together. The copper plating should be light, just a complete covering so as to prevent any peeling of the copper covering.

By the Way

At the final appraisement of the estate left by David H. Moffat, the value was placed at $14,550,000. When the first report of the executors was made the estate was valued at $9,500,000, "exclusive of certain mining and other interests."

Again the promoter. "As the temperature of the electric arc goes up to more than 4000 deg. C., it is possible to heat bodies to a temperature of more than 3000 deg. C.," (why this sudden coldness) "which gives rise to affinities still almost quite unknown, and which have nothing in common with the affinities known in chemistry." How about the affinity between a fool and his money?

A despatch states that: "Dr. Douglas Mawson, an antarctic explorer, declares he has discovered a lode of radium ore three miles long and from a few feet to several hundred yards wide at Mount Painter in South Australia." It will not be long before signs, will be seen, "Cook with Mawson's radium," "Use Mawson's Ready Radium Renovator for that Tired Feeling," and "Order that Radium Furnace before the Cook Leaves." It will not be necessary, however, to postpone ordering that new mine equipment as the manufacture of radium motors has not yet been perfected and the stockholders need the dividends.

An examination of the London Venture Corporation's report shows interests in the following 57 varieties of industry: A California oil company; an oil company in Ecuador; two Maikop oil companies; a Trinidad oil company; Baryta, Limited; Birtavarre copper mines (Norway); five rubber plantations; two other rubber companies; two mining companies; the National Electric Theaters; options on 10 rubber, oil, land, mining and industrial companies; an interest in a South African trading company; and an unnamed business "undertaken for very old connections of theirs." It seems to be left to the imagination of the stockholders to figure out what sort of product this industry may be expected to produce. We do not suppose there is any benzoate of soda in this variety, but it would be reassuring to have Doctor Wiley's report.

Two classes of securities find a ready sale in Massachusetts—3½ per cent. bonds and gold bricks. It is not an easy matter, says Arthur D. Little, to raise money for a sound chemical proposition which promises 20 per cent. Much the same conditions undoubtedly prevail throughout the country. Boston, which invested largely in seawater gold, the Hickman machine for converting starch to cane sugar, and the electrical process by which spruce wood was transformed into Australian wool with the grease in and the burs attached, is just now figuring its losses on synthetic rubber. It left to other communities the formula of the Altoona cobbler for burning ashes, the process for converting water into kerosene, and the Lamoine diamonds. Men who turn a box of strawberries upside down and require a pastor's certificate of character from the office boy, rush into misapplied chemistry with never a thought of expert investigation or advice.

The Standard Oil Company, after being repeatedly accused in press despatches of having fomented the Mexican revolution and later of intentions to gobble up the Texas Company and the Pearson oil interests, has issued the following statement of denial: "In the course of the late revolution in Mexico, the Standard Oil Company had occasion to deny fully and emphatically that it had contributed in any way to the revolutionary cause. Now, in the face of recent reiterations, it wishes to repeat its denial. In being revived, the story has had an additional misstatement tagged on it, namely, that the Texas Company, an oil corporation identified with the late John W. Gates, is a subsidiary of and owned and controlled by the Standard Oil Company. That is absolutely untrue. The Standard Oil Company has no interest in the Texas Company, and any negotiation Lord Cowdray may have with Mr. Gates in respect to the Pearson properties was of no concern to the Standard Oil Company."

In discussing the future of the Lake Superior copper district in connection with Mr. Finlay's recent appraisal of Michigan mines, J. Parke Channing, in an interview at Salt Lake City, is quoted as saying: "The Finlay report took into consideration nothing more or less than the immediate valuation of the mines examined for the purpose of taxation. There is no district in America where more possibilities exist for the finding of new lodes and new mines than at Lake Superior. There is no doubt whatever that the older mines like Quincy, Calumet & Hecla, the Hecla proper and Tamarack have seen their best days as producers, but on the contrary there are new mines like the Copper Range, Ahmeek, Superior, Hancock and others, practically virgin and new producers, developed to date to only shallow levels. Then in the vicinity of the Lake mine and the Indiana great possibilities exist of finding copper deposits. As a whole, therefore, the Lake Superior section bids fair to maintain for many years to come approximately the same output as in the past, the newer properties taking the place of the old. There is a great area 30 miles long that must be considered as mineral territory only partly explored today."

Correspondence and Discussion

Seeking Employment

Continuous summer examinations at widely separated points have prevented me from receiving and reading the recent numbers of the JOURNAL, and only today did I read what "engineer" had to say about seeking employment in the issue of April 22. This is an old and rather unhappy subject for some of us, yet it is always interesting to the younger members of the profession. "Engineer" comes very near hitting the nail on the head when he suggests that our technical institutions give a course "in the gentle art of being a good mixer." He does not hit it square on the head because no school, no institution, can make a good mixer out of a man who possesses none of the requirements of that art. The professors and instructors can cultivate and encourage but to reach its perfection the tendency must be born in the child and cultivated in boyhood.

There is no doubt in my mind but that the ability to meet and intelligently converse with all men on all subjects is the best letter of introduction and recommendation that a man can carry. This does not mean that his fund of information be exhaustless, that he must have a long list of good stories or that he drink as much whisky as his new found acquaintance. Exactly what constitutes a good mixer is hard to define. It is easier to point to examples. We can all point to a few among our friends and whatever their profession we are pretty sure to note that they are making a good living.

Call to mind a dozen of the well known names in your profession. Two or three of them have made their places by sheer force of ability and brains, but I warrant that the other nine or ten are pleasant fellows to meet anywhere, have hosts of friends and a fair to competent knowledge of their profession.

In my own business I frequently employ young engineers as assistants; the work is intermittent, and the men are frequently laid off. While they are with me I have an opportunity to become well acquainted with them. The majority have the intelligence to become engineers of average ability, occasionally one shows exceptional ability and a small minority have the "mixing" quality. Seldom is there a "mixer" on my waiting list, and when selecting a party of assistants from among former employees, I find good men waiting for the work, but that the "mixers," regardless of their capacities all have jobs.

I do not go so far as to say that it is better to be able "to mix" than to possess brains, but there are so many occasions when this ability has won over brains

Views, Suggestions and Experiences of Readers

that one is almost tempted to say brains do not count for much. I do say, however, that the man of average ability and a courteous, pleasant manner with everyone whom he meets, will make a greater success of life and be happier than the man of exceptional ability who makes no effort, concious or otherwise, to cultivate the good opinion of his fellow men.

Let us not urge our institutions to introduce a course in "mixing," but urge them to impress upon their students that there is a social side of life which must not be neglected and that the young engineer, if he would always keep busy, must bear in mind the old adage, "all work and no play makes Jack a dull boy."

EMPLOYER.

New York, Sept. 18, 1911.

The Cajones Mines, Oaxaca, Mexico

There appeared on p. 377 in the JOURNAL of Aug. 19, 1911, an article regarding the Cajones mine, in the state of Oaxaca, Mexico, in which it is indicated that developments do not yet warrant the erection of a mill. This item if not correct certainly does a Mr. Wright who reported upon this property, Aug. 12, 1909, a great injustice. If correct Mr. Wright has certainly done great injustice to a number of people who have bought stock in this company, through the influence of his report.

Taking Mr. Wright's actual findings, making no allowance, as a "factor of safety" as he terms it, I find this mine has in sight $324,648,000,000 worth of ore. This together with ore exposed by the developments of the last two years (if any) would certainly justify at least the erection of a small concentrating mill.

I am making a collection of curiosities and consider this report one of my most valuable specimens.

GEORGE F. EDGINGTON.

Jeffersonville, Ind., Aug. 22, 1911.

[The following is a brief extract of the "gems" from the report referred to by Mr. Edgington:

"The vein system on the Cajones property I found difficult to work out to my satisfaction, because of the heavy soil in these mountains. There is on the property a body of ore-bearing quartz . . . whether its abnormal width (600 ft.) be due to the ramification of two or more veins, forming a "chimney" . . . in miner's parlance, a "blow-out," I am unable to determine . . .

"To sample this vast body of quartz . . . .I found was impracticable; . . . to make the test as severe as I knew how, I took nine-tenths of my samples from . . . dead quartz. The average assay . . . was $17.87. The average assay of samples taken at this property by Mr. *A* was $78.23; by Mr. *B* $144; by Mr. C $120.63. Adding the four averages we find we have a total of $360.73 and dividing this by four we have an average assay value of $90.18 per ton."

The "engineer" then states that he measured 30,000,000 cu.ft. of ore and taking 15 cu.ft. of quartz in place to be equivalent to a ton, estimates 2,000,000 tons of ore in sight. He then multiplies this tonnage by $22, a fourth of his "average assay value," and places the value of the ore at $44,000,000. The assay value of $90.18 was divided by four "to guarantee safety." This, as our correspondent intimates, is a phenomenal report, in which a phenomenal factor of safety has been used, and if the report be true, the stockholders can certainly congratulate themselves on having a phenomenal mine.—EDITOR.]

Revolving Screens for Zinc Boxes

About two years ago, there appeared in the technical journals, references to a new method of precipitating gold and silver solutions by means of zinc. In this method, as I remember it, the zinc was used in the form of clippings, which were held in small cylindrical screens or trommels; these trommels were placed in the compartments of the ordinary zinc boxes and revolved slowly by any suitable means.

Nothing has been published lately regarding this scheme; and I wish to inquire whether any readers of the JOURNAL know if any further work has been done with zinc clippings by cyanide operators.

From the meager accounts which appeared, and some information which reached me through other sources, it would seem that this method, if successful in precipitating solutions to the proper degree, should be cheaper and better than any scheme now in use, including the various zinc-dust methods.

INQUIRER.

San Antonio, Tex., Sept. 11, 1911.

Discovery of Gold at Pitkin, Colorado

SPECIAL CORRESPONDENCE

At the close of the summer season of mining in the State of Colorado, what has been accomplished? After discounting all the buncombe and "boosting" that has been talked and written, I may say indisputably that a sharp revival has begun. Perhaps the buncombe and all that helped, for it often creates a wave of excitement toward a certain camp. Many unwise and some wise men rush in and spend their money, time and labor, and when the wave recedes, carrying with it the flotsam and jetsam of disappointed hopes, there is left on the shore of actuality eight or 10 really big mines; for all the balderdash must have, and has had, some real value behind it, or it would not count. To start things going it needs what is termed a "boom" which, though it has its reactions and disadvantages, is in the end a blessing.

In driving on a vein of ore, it might well be said: "Thou art so near and yet so far," or *vice versa*—for how often have we heard of a few feet further on a once abandoned mine, uncovering a bonanza—or, of what was supposed to be the wall of a vein being shot into and disclosing a rich ore streak that had been run parallel with it for a long distance—such occurrences as induced the Irishman to exclaim: "Well! I'll never quit again till I drive 2 ft. further."

It has been said by a mining engineer that the trouble with Colorado is, that the old mines are dying the death that comes to all mines in time, and that no new camps are being discovered. The latter, however, is not the viewpoint taken by the mining fraternity of the State. It is going to be disproved, and the first instance of it is now recorded. In this case, however, it cannot be called a new camp, but the discovery of hitherto unopened gold ores in what has been looked on as a silver-lead country. It will be remembered that this has happened often before in Colorado, notably in Leadville; in the Camp Bird of Ouray, what was silver-lead on the surface; in the Tomboy, the discovery shaft of which was in large-cube galena, and was abandoned and relocated each year for several years in the early days; in the Virginius of the Caroline Mining Company, which in 1878 showed on the surface about 8 in. of 200-oz. silver and lead ore, and at depth produced rich gold ore, and so on *ad infinitum*.

A BOOM AT PITKIN

The latest candidate for "boom" honors is near Pitkin, in Gunnison county, where Fairview mountain rears its crest about 14,000 ft. above sea level. This mountain or that part of it known as the Armstrong Gulch area, is underlaid by an uptilted sedimentary series which dips toward Armstrong gulch from all directions, the lower quartzite outcropping on the outer rim with a dip of 30 deg. to 5 to 13 deg. in the center. The orebodies are replacement deposits in the dolomite, generally at the contact between the blue limestone and the Fairview shale, the character being rich silver-lead with some stephanite and gray copper. The mines are exposed in Armstrong and Hall's gulches, most of them being situated near the circumference of the basin.

The silver-lead mines, such as the Fairview, were worked in the early days at their outcrops which are at great elevation. The one named is down 800 ft. and the ore stoped out. Most of these were abandoned and the whole mountain, comprising about 5000 acres, and upward of 600 claims, were acquired by A. E. Reynolds, who through his intimate knowledge of similar occurrences of the ore in Leadville and Aspen, pinned his faith to the district and is now attacking the deposits by driving long tunnels, most of which are within 200 to 400 ft. of meeting the bedded deposits on their dip. The possibility of the results of this work is left to the imagination or judgment of the reader.

REYNOLDS' FAITH REWARDED

In addition to this, nearer the base of the mountain are true-fissure gold-bearing veins in the underlying granite and schists, which have their course toward and underneath the bedded deposits above mentioned. Mr. Reynolds also acquired a number of these, and is developing them by tunnels, which intersect them, and by then driving each way on their course. This whole aggregation of mines, which is owned by the Colorado Smelting and Mining Company, better known as the Gold Links, can be worked by tunnels alone. No costly pumping or hoisting machinery is needed, thus producing the ore at a minimum of cost. Twenty thousand feet of work has already been done, and $1,000,000 expended on the property by Mr. Reynolds. A 50-stamp mill on these gold veins is producing bullion. A strike of a large body of sulphide ore yielding 4 oz. gold per ton has just been made in a drift on the vein from a crosscut tunnel, which was driven 4000 ft. before striking bonanza. This shows what faith and money will do, and a still more remarkable instance is the following:

About a mile distant from the latter in the same series, and probably the same vein, on what is known generally as the "Gold Links tunnel," the Carters in their Volunteer vein have just opened a vein of gold ore 7 ft. in width, which is reported to run high in gold. The vein is 6300 ft. from the portal of the tunnel, which was commenced 16 years ago by the three Carter brothers, backed by their father, the electric light and railway man of Houston, Texas, and his friends. Two of the brothers died, leaving the oldest, Carl, to continue the work, which he did bravely; but after cutting numbers of veins, none of which would pay, he nearly lost his health from bitter disappointment, and had practically given up the fight, when Mr. Reynolds and his superintendent, John Pierson, visited the last vein he had intersected, which cut a great flow of water, but no ore. From a similar experience in their own strike of ore, they saw at once an open vein, and a strong probability of ore. They urged Carter to drive on the vein a little further. He took heart, went at it and soon ran into his fortune. His strike is 1800 ft. below the apex of the vein from which rich ore was mined in the early days. The mill on the property, which was erected at a cost of $75,000 long before they found any ore to justify it, as is too often the case, will now be kept running at full capacity, and there is much joy in the whole camp. Thus we see that it is best "never to quit till we have run 2 ft. further."

On the same Gold creek and in the same district, the Raymond mine and mill is producing bullion and concentrates, this mine being also developed by a tunnel 3300 ft. long. E. M. Lamont is manager. A number of other long drainage and development tunnels are being driven, and these two last notable strikes will excite others, and who shall say that this part of Gunnison county is not going to be a repetition of Leadville in its production of the noble and baser metals?

National Safety Demonstration

Owing to the inability of President Taft to be in Pittsburg before the last of October, the dates of the national mine-safety demonstration previously announced as Oct. 26 and 27, have been postponed to Oct. 30 and 31. The President will witness the demonstration at Forbes field on Oct. 31. The special demonstration to be given by the Bureau of Mines at the arsenal grounds, Fortieth and Butler streets, and at the experimental mine at Bructon, Penn.

Mine Cave Causes Train Wreck

Four cars of a freight train of 54 cars on the Delaware & Hudson Railroad dropped into a mine cave between Mayfield and Carbondale, Penn., at 9 p.m., Sept. 12. The surface gave way under the engine, which was running at a fairly rapid rate. The momentum of the cars pushed the locomotive out of the cave, but four of the cars were smashed into kindling. The cave is 20 ft. deep and about 100 ft. wide.

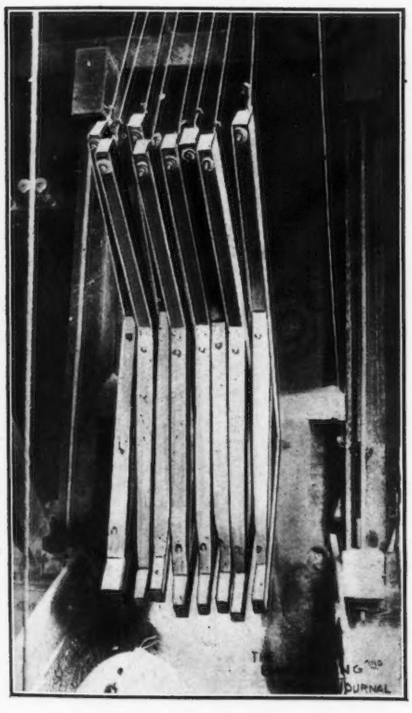
Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Finger Chutes at Mills

The advantages of using finger gates at mines where many large chunks of ore come from the stopes have long been appreciated, but the applicability of the idea at mills is not so well recognized. One



FINGER CHUTE, DESERT MILL

place where finger chutes are used about milling plants is at Millers, Nev., where the ore coming from the receiving bins is fed to the gyratory crushers through finger gates. This permits the chute to be left well open, so that it is not likely to become stopped while the attendant is at work elsewhere. In case a chunk does get down into the mouth of the bin while the attendant is away, it can be worked through without fear of the the crusher being swamped by a run of ore. Moreover, the feed to the crushers can be quickly stopped at any time, as the fingers hold the ore back in the bin and only the feed below the bin mouth works down to the crushers.

The accompanying illustration shows the method of hanging these fingers. They are framed from 4x8-in. timber, and a shoe of sheet iron is fastened to the lower limb of each finger to protect it from wear. By means of a rope attached to the upper end of the finger and passing over a pulley above, the hight of opening is regulated for each individual finger of the gate.

A Tailings Elevator on a Dump

BY W. F. BOERICKE*

Where it is impossible to dispose of tailings by gravity, on account of lack of slope, or absence of a stream sufficiently large to carry the tailings without damming its channel, bucket elevators are a usual recourse. These vary in hight from 25 to 50 ft. or more, and lead from the side of the mill by open launders to the place where it is desired to pile the tailings. In time, of course, the pile will rise so high that it is impossible to give the launders sufficient slope to carry the tailings. In such a case a second elevator, known locally as a booster, may be built on top of the tailings pile, and the flow from the launders be reëlevated, and so distributed over another area. This is usually more convenient than building the original elevator higher, as it saves a shutdown, and insures freedom from worry over tailings disposal for a longer time. It is particularly convenient where electric power is available, and the booster elevator can be driven independently by a small motor. In some cases, where the distance between mill and booster does not exceed 500 ft. or so, rope drive from the line shaft of the mill is successfully used.

The data in the following case may prove interesting to one who is confronted with a similar problem of tailings disposal. The mill in question treated 400 tons of rock daily, making a recovery of about 10 per cent. in concentrates. The crushed ore was screened through a ½-in. revolving trommel, and the tailings, having passed over the rougher jig, were lifted by the ordinary bucket elevator and discharged into a launder, lined with semicircular iron troughing, and sloping 1⅜ in. per ft. About 400 ft. from the mill the booster was built on top of the tailings pile. To insure stability, a concrete foundation was used, and the tailings well packed around. The building had two sections, separated by a partition, one having space for the boot, elevator belt, etc., while the other had a ladderway and contained the driving belt that ran from the top pulley to the motor in the inclosed motor house.

The dimensions of the building were—length 12 ft., width 7 ft., total hight 30½ ft. Center to center distance of top and bottom pulleys was 27 ft. The boot was 2½x12 ft., with a depth of 3 ft. It was aimed to have the launders discharge into the cups on the belt as much as possible, as considerably less power is needed in such case than where the cups must scrape the tailings from the floor. The elevator belt was of rubber, 16 in. wide, and 62 ft. long, carrying iron cups 16x6x6 in., reinforced by pieces of back leather and bolted through. The cups were spaced 1 ft. apart. The driven or cup pulley at the top was wood lagged with pieces of 1½x3-in. plank, to increase adhesion, the belt naturally being wet at all times. This made its diameter 33 in. The cups discharged into a lip on top, 3½ ft. deep, from which the launders ran.

The elevator was driven by a 60-cycle, 220-volt, 7.5-h.p. induction motor running 900 r.p.m. which drove a 50-in. pulley at top of the booster with a 10-in. belt. This was cut down by gearing to give the necessary belt speed, which should be the same as the mill elevator, in this case 390 ft. per min. The power consumption averaged 3.6 kw. (4.8 h.p.), which is not excessive, the pulp being about 1:5, and the elevator handling 360 tons in 18 hours.

Such an elevator as this can be erected in a short time and after once being in running order needs absolutely no attention save occasional oiling of the bearings and renewal of the elevator belt when worn out. The tailings after leaving the launder are partially dewatered before they are allowed to run out. For this purpose a cubical box 3x3x3 ft. is used, the excess of water and slimes overflowing near the top, while the heavier tailings are discharged through

*Mining engineer, Mineral Point, Wis.

spigots at the bottom. If tailings carry a large proportion of water they will be distributed over a wide area, on a gentle slope. In this case, the ground available for stacking was limited; hence it was desirable to pile them at as steep an angle as was possible.

Fuel Oil Specifications

In consequence of the succe s that has attended the use of heating-value specifications in buying and selling coal, there has arisen a demand for similar specifications, based on careful tests, to govern the purchase of fuel oils and the refined products of petroleum. The U. S. Bureau of Mines has therefore issued *Technical Paper* 3, by Irving C. Allen, on "Specifications for the Purchase of Fuel Oil for the Government," with directions for sampling oil and natural gas.

General specifications for the purchase of fuel oil should cover the following points: In determining the award of a contract, consideration should be given to the quality of the fuel offered by the bidders, as well as the price.

Fuel oil should be either a natural homogeneous oil or a homogeneous residue from a natural oil; if the latter, all constituents having a low flash point should have been removed by distillation; it should not be composed of a light oil and a heavy residue mixed in such proportions as to give the density desired.

It should not have been distilled at a temperature high enough to burn it, nor at a temperature so high that flecks of carbonaceous matter began to separate. It should not flash below 60 deg. C. (140 deg. F.) in a closed Abel-Pensky or Pensky-Martens tester. Its specific gravity should range from 0.85 to 0.96 at 15 deg. C. (59 deg. F.); the oil should be rejected if its specific gravity is above 0.97 at that temperature. It should be mobile, free from solid or semi-solid bodies, and should flow readily, at ordinary atmospheric temperatures and under a head of one foot of oil, through a 4-in. pipe 10 ft. in length. It should not congeal nor become too sluggish to flow at 0 deg. C. (32 deg. F.). It should have a calorific value of not less than 10,000 cal. per gram (18,000 B.t.u. per lb.). A standard of 10,250 cal. may be used and a bonus be paid or a penalty deducted when the fuel oil delivered is above or below this standard. It should be rejected if it contains more than 2 per cent. water; more than 1 per cent. sulphur; or more than a trace of sand, clay or dirt.

Each bidder should be required to submit an accurate statement regarding the fuel oil he proposes to furnish. This statement should show: The commercial name of the oil; the name or designation of the field from which the oil is obtained; whether the oil is a crude oil, a refinery residue, or a distillate; the name and situation of the refinery, if the oil has been refined.

The Kimberley Hoisting Skips*

The type of skip used in the shafts of the Kimberley diamond mines is shown in Fig. 1 of the accompanying illustration. The skips at the Kimberley and De Beers mines have a capacity of 100 cu.ft., equivalent to five tons of blue ground. The original skips at the Wesselton, Bultfontein and Dutoitspan mines have a capacity of 165 cu.ft., equivalent to about eight tons. These have recently been enlarged to a capacity of 210 cu.ft., so as to carry approximately 11 tons of "blue ground." The weight of the five-ton skip is 0.78 of the weight of blue ground it carries. For the eight- and 11-ton skips these figures are 0.7 and 0.6, respectively.

In view of the heavy hoisting, special care has been taken to insure a strong and substantial arrangement for shaft guides for these skips. The guides, which are shown in Fig. 2, are of the flange-channel section, 12 in. wide over the flanges, and 6 in. wide over the working face, and with a depth of 4 in. The method of attaching the guides to the shaft timbers is shown in the accompanying illustration, from which it will be seen that there are no projections, such as bolt-heads, etc., on or about the working face of the guides.

The two skip compartments in each of the two shafts of the De Beers mine measure 4 ft. 4 in. by 6 ft. in the clear; at the Kimberley shaft the two compartments measure 4 ft. 4 in. by 6 ft. in the clear; at the Wesselton one shaft has two compartments measuring 4 ft. 10 in. by 7 ft. in the clear, while the other shaft has two skip compartments 4 ft. 10 in. by 7 ft. 6 in. in the clear. At the Bultfontein one shaft has two compartments 44 in. by 6 ft., and the other shaft two compartments that measure 4 ft. 10 in. by 7 ft. in the clear, while the two compartments of each of the two Dutoitspan shafts are each 4 ft. 10 in. by 7 ft. in the clear.

*Excerpts from an article entitled, "The Kimberley System of Handling Large Quantities of Ground, Etc.," by Alpheus F. Williams; *Journal* of the South African Institute of Engineers.

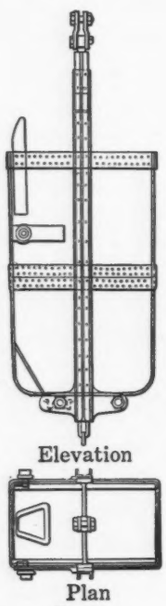


FIG. 1.
11 Ton Skip.

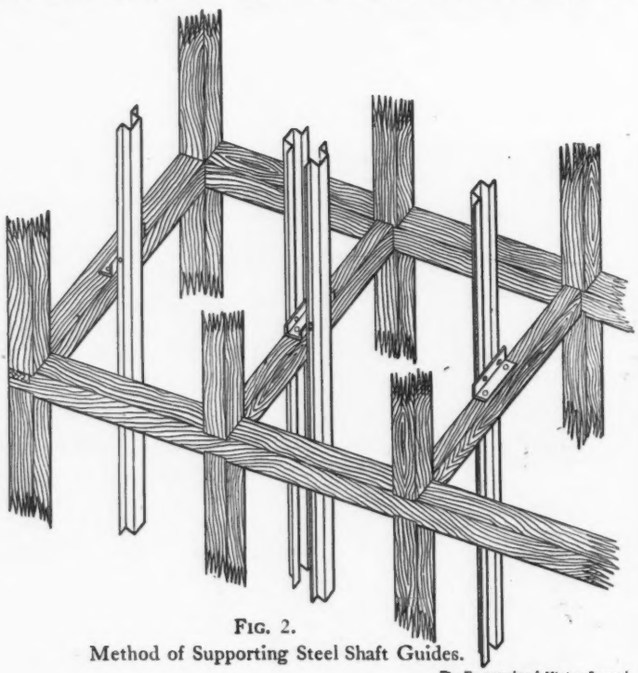


FIG. 2.
Method of Supporting Steel Shaft Guides.

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SKIP AND GUIDES USED AT KIMBERLEY DIAMOND MINES

Use for Old Blueprints

In the engineering department of every mine office, blueprints will accumulate until the quantity has reached amazing proportions. Some companies keep a record and file of all prints made and at periodical times destroy the old ones. No matter what method is employed to handle them, at some time great quantities of these prints are destroyed in some way and the paper is a total loss. In addition to this, at the time of printing, there is sure to be a certain waste due to poor exposures, blotchy paper, etc. A method for turning this waste into a useful article is presented by E. B. Birkenbend, *American Machinist*, of July 27, 1911.

These old or useless prints may be bleached by immersing them in a soda bath, containing 4 oz. of soda to one gallon of water. If it is desired to bleach only a portion of the print, this may be done by painting that part with this solution. By washing the prints in fresh water, after bleaching, any discoloration is prevented. The blank paper thus obtained furnishes a fair grade of sketch paper, and there are numerous other uses to which it could also be put.

Drilling in Tunnel Headings

In driving tunnel headings of oval or semi-circular cross-section, ranging from 10 or 12 up to 18 or 20 ft. in width on the floor, a customary method is to employ two columns, each carrying two drills. In order to complete the round and break the ground to the best advantage it is necessary either to move the columns or to set up a third column. A device for obviating this delay has been used recently with success in tunnels on the line of the New York water-supply aqueduct, states a contributor to *Mines and Quarry*. It consists of a column arm of unusual length, 30 or 36 in. This is set near the bottom of the column, and gives the drill a much wider range in placing the holes than the arm of ordinary length.

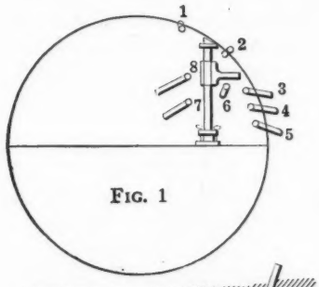

FIG. 1

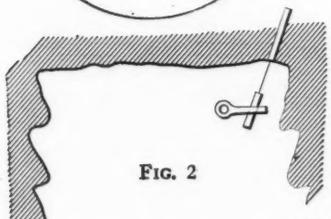

FIG. 2

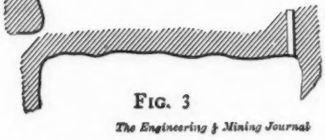

FIG. 3

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DRILL COLUMN IN LARGE TUNNEL

With this long arm a tunnel wall or rib may be carried straight, instead of as a series of offsets, with the resulting roughness, which must be reduced by filling or trimming. In the sketch, Fig. 1, is shown a column with a short arm. It must be set far enough from the rib to permit the arm to swing between the rib and the column when the arm is placed for drilling the holes at the top of the tunnel.

Hole No. 1 is drilled with the arm on the left side of the column. The arm is then swung to the position shown in the cut, and holes Nos. 2, 6, 7 and 8 drilled. If this arm or a bottom arm of the same length is used for the lower rib holes, Nos. 3, 4 and 5 would be drilled as shown in Fig. 2, leaving an offset.

The use of a long arm on this column allows holes Nos. 3, 4 and 5 to be drilled as shown in Fig. 3, and the difference in appearance of the rib when the two arms are used is shown by Figs. 2 and 3. These arms are, of course, made of extra-strong material to withstand the strain placed on them when the drill is working at the outer end.

Power Required for a Stamp Mill

BY H. S. KNOWLTON*

In connection with a test of the power consumption at a gold mill in the Idaho Springs district, the Central Colorado Power Company, of Denver, recently made a determination of the effect of shutting down individual stamps upon the performance of the engine driving the installation. The equipment of the mill comprised the following machinery:

Crushing and Sampling Plant—One 9x15-in. Blake crusher; two Vezin samplers, 36x24 in.; two 10x6-in. bucket elevators, 60 ft. and 53 ft. 7 in.; two Mitchell sample crushers and one sample grinder. Fine-crushing department: Twenty 800-850-lb. gravity stamps, 7-in. drop, 88 drops per minute.

POWER REQUIRED FOR A STAMP MILL

	Average Indicated Horsepower from Engine Cards			
	Without Crusher or Sampler		With Crusher and Sampler	
Number of Stamps Dropping	Without Generator	With Generator	Without Generator	With Generator
20	46.3	49.3	52.3	55.3
19	45.0	48.0	51.0	54.0
18	43.8	46.8	49.8	52.8
17	42.6	45.6	48.5	51.5
16	41.4	44.4	47.3	50.3
15	40.2	43.2	46.1	49.1
14	39.0	42.0	44.6	47.9
13	37.8	40.8	43.6	46.6
12	36.6	39.6	42.4	45.4
11	35.4	38.4	41.2	44.2
10	34.2	37.2	39.9	42.9
9	33.0	36.0	38.7	41.7
8	31.8	34.8	37.5	40.5
7	30.6	33.6	36.3	39.3
6	29.4	32.4	35.0	38.0
5	28.2	31.2	33.8	36.8
4	27.0	30.0	32.6	35.6
0	22.2	25.2	27.6	....

Concentrating and Regrinding Department—Seven concentrating tables; one vanner; three tailing pumps, one mill-water pump; one 5-ft. Colo. Iron Works grinding pan and one agitator, not operated during test. Miscellaneous: One 3-kw. lighting generator, 115 volts; one 4-kw. generator, 6 volts, for energizing mercury traps and agitator and one 17-kw. dynamo not operated.

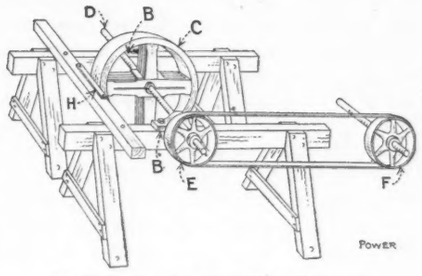
The mill is operated continuously, except on Sundays. The power requirements with varying number of stamps are shown in the accompanying table.

A cement for joining wood with metal, is made by mixing litharge with sufficient glycerin to form a paste.

*Mining engineer, 23 Richardson street, Newton, Mass.

A Makeshift Pulley Lathe

Some years ago in a little shop it was necessary to turn several large wooden sheaves. As no lathe in the shop could turn sheaves over 3 ft. in diameter, the job was done as follows: Two ordinary carpenters' horses were procured, upon which were bolted the bearings *B B*, shown in the accompanying illustration. The sheave *C* was mounted on the short shaft *D*, which was then placed in the bearings.

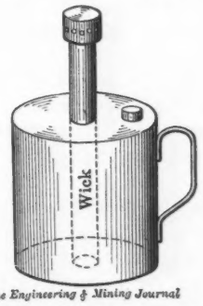


HOW THE PULLEY WAS TURNED

The pulley *E* was put on the shaft on the outside of one bearing. The two horses were placed close together so as to bring the pulley *E* in line with the pulley *F*, which happened to be a small pulley on the end of the engine shaft. After securing the horses to the floor the belt was put on the pulley and a piece of wood nailed across from one to the other, as at *H*, to which a piece of iron was fastened for a tool rest. After slowing the engine down to a suitable speed and using a heavy hand gage over the tool rest *H* the groove was turned.

A Homemade Gasolene Torch

A simple gasolene torch for mine shops may be made by a handy smith from an old tin can, says *Shop Notes Quarterly*. Punch a hole in the center of the top of a pint can and insert a piece of ¼-in. gas pipe to within ⅛ in. of the bottom of the can, letting the pipe extend out of the can 4 or 5 in., soldering it in position.



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GASOLENE TORCH MADE FROM A TIN CAN

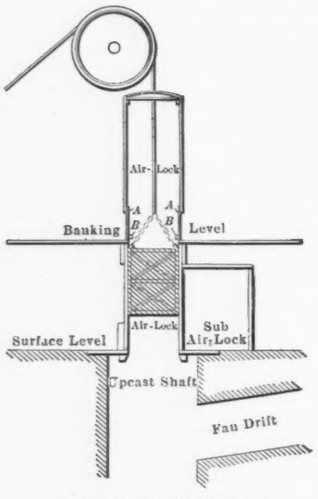
Screw a common cap on top of the pipe and drill eight or ten holes around the cap. Fill the pipe with wicking or asbestos.

When ready to light the burner, heat the can at the top, and hot gas will flow from the holes.

An Airlock for a Shaft

The accompanying sketch from *Mining Engineering* illustrates a suitable arrangement of airlock to enable winding operations to be conducted at the surface of an upcast shaft so as not to interfere with the ventilation of the mine. It is essential where an exhaust fan is used for ventilating purposes that the top of the upcast shaft be securely sealed to prevent the air escaping direct from the surface to the fan. Any escape of air in this manner means a waste of work for the fan and loss of air through the mine workings. Where winding is carried on at the upcast shaft, air will escape to a more or less extent, but this escapement may be reduced to a minimum by a suitable arrangement of airlock.

Where winding is conducted, the casement must be extended to a suitable hight to allow the cage to be brought up to the banking level. As shown in the sketch, it will be seen that the casement or airlock is extended from the ground level well up through the headgear.



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A SHAFT AIR LOCK

In this arrangement important parts are the vertical slide doors *A A*. These doors are made of ¼-in. iron plate, strengthened by bands or straps of the same material. The doors are balanced by weights and slide in grooves, and are opened when the cage comes to the banking level. The top of the cage comes in contact with the projections *B B* on the bottom of the doors and raises them, thus allowing banking operations to be performed; on the descent of the cage the doors close by their own weight.

The cages and casement are specially constructed to fit tightly so that each cage acts as a door when at the surface or banking level. To further prevent an inrush of air, the bottom of each cage is made much deeper than usual. The sub-airlock is for the purpose of changing the cage when required for repairs.

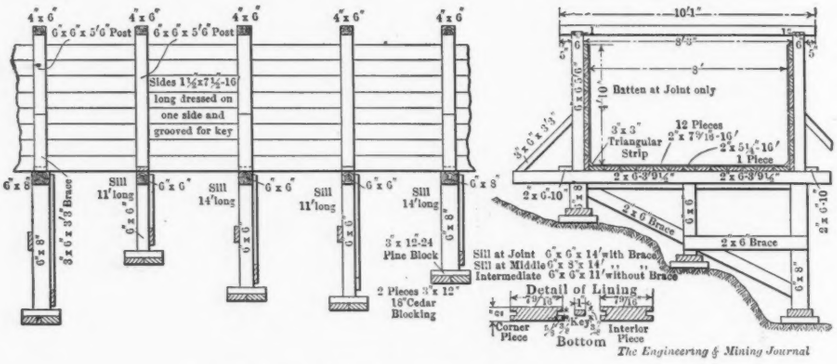
Details of Flume Construction

BY W. G. DEVEREUX*

The accompanying illustration shows the details of a flume that was recently built for the Melones Mining Company. The use of a grooved lining was an experiment at this place, but it has been tried with satisfactory results at other places. It is superior to a batten flume when finished, but is more expensive to construct.

The choice between stringer flumes, those carried on stringers between bents at each 16-ft. box joint, and bent flumes in which there is a bent under each box post, or in which the box posts and bents are one timber, is entirely dependent upon the hight of the box above the ground. On high flumes, the stringer type requires less lumber.

Each 16-ft. box of the flume required 1304 bd.ft.: 365.5 bd.ft. for the box frame; 548.2 bd.ft. for lining, and 390.5 bd.ft. for the substructure. The cost of building such a flume was $29.50 per M. bd.ft., with lumber at $18.75 per M. and labor at $2.50 and $3 per day. The depreciation of a flume averages about 10 per cent., besides maintenance, although flumes may last longer if heavy leakage can be prevented.



The Engineering & Mining Journal

THE FLUME OF THE MELONES MINING COMPANY

Coloring Concrete Work

Where colored concrete work is needed the following mixtures are recommended (*Cement Age,* June, 1911). The quantities given are per barrel of cement and sand. The sand must be thoroughly dry. In mixing the colors should be made deeper than the required tint, as drying results in bleaching. Venetian red and common lampblack should not be used, as they are liable to run and fade. The schedule for colors is as follows:

For brown, 25 lb. of best roasted iron oxide; or, 15 to 20 lb. of brown ochre; black, 45 lb. of manganese dioxide; blue, 19 lb. of ultramarine; buff, 15 lb. of ochre (this is likely to reduce considerably the strength of the mixture); green, 23 lb. of greenish-blue ultramarine; gray, 2 lb. of boneblack; red, 22 lb. of raw iron oxide; bright red, 22 lb. of Pompeian or bright English red; purple, 20 lb. of Prince's metallic; violet, 22 lb. of violet iron oxide; yellow, 22 lb. of ochre.

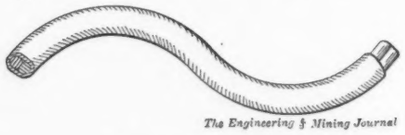
*Manager, Melones Mining Company, Melones, Calaveras county, Cal.

An Inexpensive Flexible Curve

Every draftsman has at some time or other probably felt the need of a flexible curve or rule, but the expense has led many to do without it. M. R. Wells, in the *American Machinist,* describes a rule which he has found to be as good in practice as any that can be bought and which can be made at almost no cost.

Procure two pieces of solder wire 3/16 in. diameter and of the desired length. These can be straightened by rolling them on any smooth surface, and while in this shape, one side should be drawfiled to give a flat surface equal in width to perhaps half the diameter; at the same time the ends of the wire should be rounded.

Next, procure a piece of ¼-in. rubber tubing slightly longer than the pieces of solder wire, and while the flat sides of the wires are held together, work the tubing over them in the same manner that tight glove fingers are first put on. This latter process will be much simplified if the tubing is first soaked for a while in gasolene, which will cause it to increase in diameter for a short time, and will also act as a lubricant while placing the tube. The gasolene will soon evaporate and leave the tube tight on the wires.



The Engineering & Mining Journal

A HOMEMADE CURVE

Each horsepower of boiler will supply approximately from 240 to 360 ft. of one-inch steam pipe or 80 to 120 sq.ft. of surface for heating purposes.

Filling Mine Stopes with Sand

By William H. Storms *

This practice has proved successful in Europe, Australia and South Africa, and is worthy of trial in some of the metal mines of the United States.

*Mining engineer, Berkeley, Cal.

Sand filling of stopes, though not new in some of the coal-mining regions of Europe, in Western Australia, and more recently on the Rand, has not been extensively attempted, if at all, in the metal mines of the western United States. There is nothing impracticable in sand filling, and where the conditions are such that it can be economically applied, it seems to be the best method of filling mine workings.

The technical journals and transactions of some of the mining societies have of late contained a number of interesting contributions on sand filling. The art seems still to be, to some extent, in the experimental stage, particularly as regards its application to metal-mining practice. Important factors in the successful employment of sand filling are: the dip of the vein, the method of mining and the situation of the available sand with reference to the shaft or other channel through which the sand may be introduced into the mine workings. By successful is meant economically, as well as mechanically successful, for without doubt mine workings could be easily filled with mill tailing by any one of a dozen different methods, if the expense of the operation were of no moment. To be successful, therefore, the method of sand filling must be lower in first cost than any other method, and must be free from the danger of disaster in the future.

The scheme may be considered scarcely to have advanced beyond the experimental stage in the metal-mining regions outside of Western Australia, and, therefore, it is not known whether the risks inherent to this method of filling stopes are really greater in wet mines than in those that are dry, or comparatively so, like those of Western Australia and of the Rand.

The Practice in European Collieries

A brief résumé of what has been accomplished is interesting, as it indicates the possibilities of the system in its application to metal mines everywhere, as well as to coal mines in which latter sand filling has thus far found its greatest employment. The workings of what is known as the Shamrock mine, in Westphalia, are filled with sand. These workings are about 1900 ft. deep, and the sand is carried 1500 ft. horizontally from the shaft underground and deposited; at another mine it is carried a horizontal distance of over 3300 ft. At the Myslowitz colliery,[1] 3000 tons of sand were daily sent down into the mine for stope filling. In this mine one coal seam is 8 to 21 ft. thick, and another 28 to 37 ft., indicating that sand filling is applicable to large as well as small stopes. The sand is obtained from a bank 20 ft. thick and 1500 ft. long, steam shovels being used to load cars, which are hauled to the points of discharge by steam locomotives. There are two boreholes, one 780 ft. deep, the other 1100 ft. From the foot of these holes the sand is distributed to the stopes. In European practice one of the difficulties of sand filling is the rapid destruction of conduits, which are cut by the passing sand. In one instance wood linings passed 45,000 tons of sand before being worn out. In another case, in Germany, a white porcelain lining passed 90,000 tons, at which time it appeared to be about half worn out. A lining of glass passed only 60,000 tons, and one of earthenware about the same, before they became useless. At one mine iron pipes without lining are used, the holes cut by the sand being repaired as they occur, by means of the oxyhydrogen flame.

At a colliery near Liège, Belgium, the sand is sluiced down with water through 6-in. pipes. In one instance the pipe was 460 ft. long, with 90 lb. pressure at the bottom. The sand and water were carried by this head 2100 ft. along a level, at which point the pressure was practically nil, due to friction of the pipe. From here the sand was carried by gravity down the slope in 5-in. pipes to the place of distribution in the stopes. Another 6-in. pipe column was 1100 ft. in length, with 50 lb. pressure at the bottom. The sand was carried along a level 650 ft., down an incline 400 ft., and then along a drift 1350 ft., where the friction was found to have equalized the pressure. From this point smaller pipes were used, and a total horizontal distance from the borehole of 3600 ft. was reached. The drifts had a gradient of 1 in 100. At one coal mine in Silesia 7500 tons of sand and débris are sent down daily to fill the stopes.

In some of the European collieries crushed rock, fine and coarse together, is used for filling instead of sand. This, in America, would probably be economically impossible, except, perhaps, in a district where such material is the result of mining and metallurgical methods, as in some cases in the Cripple Creek district, where there are large dumps of waste in which the largest pieces are about ½ in. diameter. There the rock from the mine passes through a sampler, and this crushed rock accumulates in large quantity. Where rock is not thus obtainable, as a sort of byproduct, it would be an expensive filling.

Practice in Australia and South Africa

In Western Australia, mill tailing is sent down into the mines through shafts from the surface. The tailing may contain up to 25 per cent. moisture; if more, it packs in the passes and gives considerable trouble. When the sand is wetter than this it is sometimes allowed to remain on the surface for a few days to dry out. The sand is distributed by means of a belt conveyer placed on an old level running over the stopes to be filled below. Sand filling has been practised in the Western Australia mines for the last 14 years, so may be said to have there passed the stage of experiment. The cost is stated to be about 20c. per ton of ore extracted, which certainly compares favorably with the most economical employment of timber in American mines.

There appears to have been more difficulty in applying the method on the Rand than elsewhere, due to conditions there, and to the character of the sand. It should be understood that clean, sharp sand does not constitute an ideal filling material by any means. It is compact, and possesses considerable cohesion when wet, but when dry it runs readily, then becoming an element of no little danger if a bulkhead breaks, or if it gets an opportunity to run, from any cause. Most miners had as soon be drowned as smothered beneath tons of dry sand. The mill tailing of the Rand contains little beside silica, and, therefore, does not become consolidated, so that if a bulkhead breaks, because of decay, or in case it becomes desirable to remove it, the sand will run freely if dry, and this it is necessary to avoid.

At the Silesian coal mine above referred to, the material used in filling consists of ferruginous sand, clay, rock, slag, and other débris. These are handled with a steam shovel. To this mixture are added bricks, slate and earthy coal, all of which is run through a rock breaker. In addition to this, hot furnace slag is run by launders to the mixing machinery. Much of this material is hauled 11 miles by railroad to the mines. The mixture is sent down into the mine through porcelain-lined pipes which pass through the shaft. Wooden bulkheads are constructed in the mine to hold the filling. Owing to

[1] *Journ. Chem., Met. and Min. Soc., of South Africa, July, 1910.*

its composition—a mixture of sand, clay and iron, besides considerable coarse material—it has sufficient porosity to permit the water to escape, and later becomes a solid mass which can only be broken by a hammer; this is quite in contrast with a sand filling that will run through a knothole at every opportunity.

Retaining the Filling

It is evident that under pressure the sand can be carried at least as far as 3600 ft. horizontally from the point of discharge at the shaft, winze or borehole. The size of the pipe used will naturally affect this distance, as there will be less friction in a large than in a small pipe. If, in any case, the pressure is too great, owing to the great depth of the shaft, the pipe may be broken into two or more units, with a hopper at the top of each unit. As friction appears to be so important it is improbable that the pressure will ever be found to be too great. The principal difficulty in the application of the method to the mines of the Rand seems to have been the construction of long bulkheads at the bottom of extensive stopes which would safely hold the load of sand and water poured in upon it from above. Mr. Johnson estimates the total pressure upon a bulkhead, 400 ft. long, 6 ft. high, in a stope lying at 30 deg., with sand filling piled to the hight of 200 ft. above it, at about 10,800 tons, or 9000 lb. per sq.ft. These figures evidently contemplate 200 ft. on the slope, not vertical measurement, and that the sand is perfectly dry. Thoroughly wet sand will weigh about 120 lb. per cu.ft., which would greatly increase the weight on the bulkhead, if the total weight of the sand and water rest upon it. This, however, is improbable, in the case of a stope only 6 ft. high, as at so low an angle as 30 deg. much of the weight of the sand would be on the foot wall, whereas the pressure of a column of water on the bulkhead would be directly proportional to its hight.

It is quite evident that the construction of long bulkheads, such as described, at or near the bottom of a stope, is not the safest way of holding back the sand. If it is run in wet, the sand will settle and some water will rise to the surface of the sand, and this may be drained or pumped away, while some of the water will surely find its way out through holes and interstitial spaces in the bulkhead, and even in the surrounding rocks themselves, if the pressure be great. Anything that could become a tributary cause to a mud rush must be carefully avoided, and to me it seems that a long bulkhead, which may possibly give way under pressure, is one of the things that might result in such a catastrophe. For this reason it appears desirable that some other form of support than a wooden, or even a concrete bulkhead, or "barrier," as they call it on the Rand, is desirable. I would suggest that the better plan were to leave a solid back of ore, from 10 to 15 ft. thick over the gangway, and to cut through it at only such places as are necessary for manways, for ventilation and for chutes. This, together with shrinkage stoping (drawing away only sufficient broken ore to make room for the miners at the top of the stope), should make sand filling possible anywhere that this mining method can be applied. When the stope is finished all of the broken ore may be drawn out, the chute holes and manways sealed by heavy timber bulkheads, in which provision has been made for the seepage of water through filters, and then running the mill pulp into the abandoned stope. Later the solid backs left over the gangways could be mined, if the filling became solid and coherent; if not, these horizontal pillars could be robbed as far as might be considered safe. True, some loss of ore might be entailed by this method, and this would have to be charged to mining expense. Mining cannot be carried on without cost, and the constant aim of the mining engineer is to mine safely at the lowest possible cost. If the ore that must be lost is so high grade as to increase the expense greatly, then the mine is rich enough to mine by some other method which will permit the removal of all the ore.

Manipulation of the Filling Process

If the sand, with sufficient water to carry it, be poured in at the top of one end of a stope, the solids will settle to the bottom at the end beneath the entry pipe and gradually pile up there, sloping at a low angle toward the other end of the stope where fairly clear water will collect. At least, that is the result when tailing from a mill flows into a pond, and it is only reasonable to expect that it will act in the same manner in a stope, or in any sort of reservoir. It is desirable, even necessary, to get rid of this superfluous water as speedily as possible. It would, in time, doubtless drain out more or less completely, but it should be removed as fast as it enters, leaving only that water that saturates the sand to percolate and drain out through the filters previously provided in the bottom, in the same manner that it does in cyanide tanks.

A. R. Hughes has described (*Journ. Chem., Met. and Min. Soc. S. A.*) a device for draining water from a sand-filled stope in the Simmer & Jack mine on the Rand. The stope was completely inclosed, either by solid rock, by hand-built rock walls, or by timber bulkheads. The necessary filters were provided at the bottom of the stope for the drainage of the sand. A small inclined raise was driven from a crosscut beneath up into the stope, and in this was placed a wooden box 12 in. square, having on its upper side a series of frames covered with cocoanut matting. A 6-in. pipe was fitted into the lower end of this box, the pipe being then surrounded by a carefully placed, dry, rock wall. The top of this filter box extended above the surface of the water, and was carried up in 12-ft. telescoping lengths, as the sand accumulated in the bottom of the stope. The superfluous water passed freely through the cocoanut matting and ran down the box into the pipe and out on the level below, where it was conducted to a tank and hoisted to the surface.

This method of handling the water is similar to that which I have heretofore suggested, and contemplates that the unfilled portion of the stope above the top of the filter box is always accessible to the men whose duty it is to place the additional sections of the box in position as the depth of the sand in the stope increases. Where this is not possible, or where it is too dangerous to venture, owing to impending rock falls, the filter box should be completed from top to bottom of the stope before filling begins, and it may even be deemed advisable to protect the filter box with plank, a crib of timber or, in particularly bad places, with loose rock where the stope is flat enough for such cover to remain in place. As the filter box is gradually submerged in the accumulating sand, it is essential that some means of preventing the filter from caving in under the increasing pressure be provided. To this end I would suggest that the matting be placed upon a supporting frame within the box, and that the upper side of the box be of 2-in. plank perforated with 1-in. auger holes.

Surface Conveyance of Filling

One more matter to be considered is the conveying of the sand from the accumulated pile on the dump, or from the tailing launder of the mill, to the shaft, winze, or other passage leading into the mine. In nearly every instance the mill, and consequently the tailing pile, are at a lower level than the collar of the shaft. For this reason the sand must be elevated or else introduced into the mine through a shaft, winze or borehole sunk at some lower point on the surface, and connecting with the stopes below. In many places a tunnel can be driven at a lower level than the mill, which can be connected with the workings and thus facilitate the handling of the material. Where this is resorted to it would be better to make a flat incline of it, one in which the tailing will run freely, either in a flume or on the rock floor. Mill tailing usually carries an excess of water, but it is an easy matter to dewater it to almost any desired extent by any one of the several dewatering devices on the market. A mixture of about two parts of sand to one part of water by weight, will flow on a gradient of 1 in 5. A mixture containing a greater proportion of water will run on a lighter grade.

Surveying Diamond Drill Holes

By E. E. White*

In the Lake Superior iron districts the orebodies are determined by bore holes. Diamond drills are used and as deep holes diverge from the vertical it is necessary to determine accurately their direction and dip; a description of the methods used.

*Excerpt from a paper entitled, "Surveying and Sampling Diamond Drill Holes," read at the August meeting of the Lake Superior Mining Institute.

†Mining engineer, Ishpeming, Mich.

Diamond drilling is expensive in the Lake Superior iron district, rarely costing less than $2.50 and often in hard ground $5 per ft., or even more if any of the many difficulties known to drillmen are experienced. Yet up to a few years ago little attention was paid to determining the actual course of holes underground, to accurate sampling, analysis, and location of drill holes. A description is herein given of the methods that have been developed in the course of extensive explorations in the Lake Superior district by the Cleveland-Cliffs Iron Company.

Inclination Measured by Hydrofluoric-acid Etching

It has been common practice for several years to test the inclination of drill holes by etching glass tubes with hydrofluoric acid. The apparatus used by the Cleveland-Cliffs Iron Company has been described by J. E. Jopling[1]. I have described[2] how the curvature of a diamond-drill hole can be controlled and have an example where it has been done successfully. Although the hole kept to the desired course, it failed to intersect the ore encountered in a previous hole because the direction of deviation from the vertical of the previous hole had not been determined, although the amount of deviation had been determined by the usual hydrofluoric-acid tests.

This failure to secure results led to my investigating the question of determining the course, as well as the inclination, of drill holes. After considering several methods two were chosen for trial, one of which has proved satisfactory, the other moderately so. In non-magnetic rock formations the old method of a compass suspended in gelatin is successfully used with improvements worked out by George Maas and me. Mr. Maas has patented his improved compass and his idea of using a Thermos-bottle container for the compass and gelatin. In magnetic formations a method of marked drill rods and hydrofluoric-acid tests is used. This method was described to J. E. Jopling by John Deacon, superintendent at the Republic Iron and Steel Company's properties at Negaunee, who used it in testing diamond-drill holes at the Cambria mine. We did not find it as successful as using a compass, but it is the only method that I know that is practicable in magnetic formations.

Description of the Apparatus

In Figs. 1 and 2 are shown the cases used to test for inclination and course. The latter shows the case used when it is desired to make more than one test at the same time, as it may be inserted at any point in the drill rods at the same time that the first case is used at the end of the rods. As it is desired to use in the case as large a glass tube as possible, and as the outside diameter is limited by the size of an *E* hole, a material was selected which combined the greatest possible toughness and tensile strength with non-magnetic properties. Phosphor-bronze was chosen, which is entirely non-magnetic and for which the manufacturers guarantee a tensile strength of 70,000 lb. and elastic limit of 55,000 lb. per sq.in. In a case of dimensions given in Fig. 1, a glass tube 1⅛ in. outside diameter can be used and according to Nystrom's formula for the collapsing strength of small tubes $P = \frac{4\,T t^2}{f d V L}$, using a factor of safety of 4, this case should be safe in a hole 3300 ft. below water level. A little wicking is used to make a perfectly tight joint.

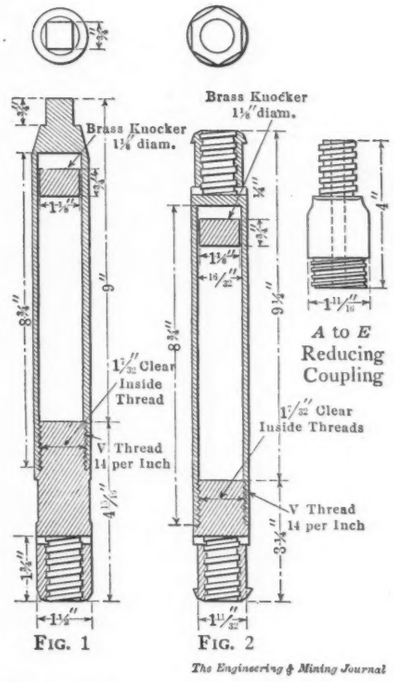


FIG. 1 FIG. 2

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BRASS CASES FOR CLINOMETER TUBES

The compass invented by Mr. Maas is shown in Fig. 3. Its advantage is that it is pivoted in a cage which prevents its coming in contact with the glass tube and insures its swinging freely in the gelatin. The cage is below and rigidly attached to the cork float.

The most accurate and satisfactory method of testing the course of a hole is to use the compass in a glass tube about 6 in. long and open at each end. A section of rubber stopper is forced into the tube, leaving about 1½ in. for acid at one end and 4 in. for gelatin at the other. A small weighed portion of dry gelatin is carried to the drill and dissolved in water, care being taken that the water has no chance to evaporate while dissolving the gelatin. The proportions are so chosen that, when dissolved, the solution will keep liquid as long as possible after being lowered in the drill hole and yet will become perfectly solid when cold. For instance, using Nelson's Improved Brilliant Gelatin we use 5 to 6 grams and dissolve it in 50 cc. of water. In a hole where the rods can be lowered in 20 minutes or less a 1⅛-in. tube is used with paper wrapping. When it takes from twenty to thirty minutes to lower the rods a 1-in. tube is used with several wrappings of paper. If deeper than this a Thermos bottle is used and by using a paper wrapper the gelatin may be kept liquid 50 min. The time the gelatin remains liquid was determined by tests in ice-water at 43 deg. F., which is the temperature of the underground water.

Making the Measurements

In the first two cases when the Thermos bottle is not necessary and the determinations are to be made in nonmagnetic formations, the dissolved gelatin is poured into the tube and heated as hot as possible by immersing the tube in water heated to boiling by live steam. When hot the compass is dropped in and a stopper placed in that end, then about one inch of dilute hydrofluoric acid is poured into the other end and that end closed. The tube is then wrapped in paper and placed with gelatin end up in the bronze case, which is attached to the bottom of 20 ft. of brass *E* rods and lowered into the hole, losing as little time as possible. The brass rods are screwed to the bottom of the regular drill rods, an *A* to *E* reducing coupling being used if the hole is being drilled with *A* rods. The bronze

[1] *Proceedings*, Lake Superior Mining Institute, August, 1909.

[2] ENG. AND MIN. JOURN., Sept. 17, 1910.

case and brass rods are made for an *E* hole so that they can be used in either case. If two tests are to be made at the same time another tube and compass are placed in the case shown in Fig. 2 and inserted in the drill rods at the proper point, using 20 ft. of brass rods on each side.

The tube is left stationary in the hole 50 min. after the rods are lowered, giving the gelatin time to cool and set, and the acid time to etch a good line. It is found that acid diluted with 12 parts of water gives best results. It is diluted in the office and carried to the drill in hard rubber bottles with screw tops, which are much more convenient than the paraffin bottles used at first.

When the tube is brought to surface the positions of the north and south ends of the needle are marked on the glass with a diamond point, the tubes washed out and the compass dried to prevent rusting. This tube forms a permanent record of the inclination and course of the hole at the depth where the test was taken.

The Thermos bottle is 1⅛ in. outside diameter and consists of two clear glass walls with a vacuum between as shown in Fig. 4. When it is necessary to use this the hot gelatin and compass are placed in the bottle and the bottle closed by a rubber stopper. The stopper also closes one end of a 1⅛-in. tube 3 in. long, serving to connect the bottle and tube and preserve them in the same relative position, as shown in Fig. 4. Dilute acid is placed in the tube, the other end closed, and the tube and bottle placed in the bronze case and lowered into the drill hole. It only takes the gelatin 1½ hr. to solidify in the Thermos bottle so that it is usually left in the hole only 50 min. after the rods reach the bottom, just long enough to get a good etching. It may be left in the hole over night, however, but in that case the acid is diluted more.

Recording the Data

When the tube is brought to surface the north and south points are marked on it, corresponding to the position of the compass needle in the Thermos bottle. The tube then forms a permanent record, of course, and inclination just as the 6-in. tube does. In either case the inclination is read in the goniometer described and shown by Mr. Jopling, and is corrected for capillarity according to a curve which is prepared for each size of tube, by testing tubes at known angles according to the method described by Mr. Jopling. Fig. 5 shows a curve for 1⅛-in. tubes.

It will be noted that for the larger tubes the correction is only 3¾ deg. at 45 deg., which is the maximum. The angle can be read to ½ deg. and I feel certain that the results of tests for inclination can be relied upon to within one degree.

To determine the course of the hole the tube is placed in the goniometer with the graduated circle set at zero so that the tube is vertical. If the inclination of the hole is steep the tube is twisted until the etching shows the dip to be either directly toward or away from the eye; that is, until the cross-thread bisects the ellipse etched on the glass. If the inclination is shallow it is more accurate to twist the tube so that the dip is to the right or left of the observer and in the plane of the graduated circle. The goniometer is next placed on a protractor so that the tube comes vertically over the center, and by sighting down over a straight-edge placed in line with the north and south points marked on the tube the point of the compass toward which the hole dips may be determined. Figs. 3 and 4 show tubes with acid, gelatin, compass, and north and south points marked just as they are taken from the drill hole. I intend to have another goniometer made with horizontal circle to measure the course as well as vertical circle for the inclination, but have not had an opportunity to do so as yet.

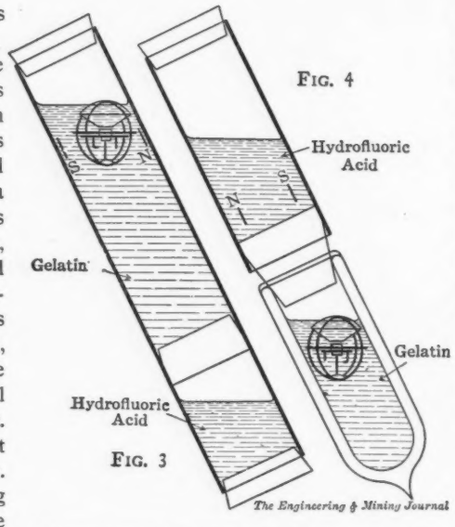

FIG. 4

FIG. 3

CLINOMETER TUBES FOR SHALLOW AND DEEP BORE HOLES

We have found the method described above is successful, and two tests at the same point usually agree. When this is not the case more tests are made and so far we have always been able to ascertain which are wrong. We have made tests at a depth of 2000 ft. but it would probably be difficult to go much deeper without using more insulating wrapping around the Thermos bottle than is possible with a bottle and case of dimensions now used.

The precautions to be taken are three in number; that the compass swings perfectly free, that is, that it does not catch on the cage and that the gelatin keeps liquid long enough; that there is no local magnetic attraction in the rock formation; and that the compass is not affected by the steel drill-rods or casing or by other iron in the hole. The first precaution is easily taken; the second can only be judged by a knowledge of the formation and by taking tests at different depths. If these are concordant there is probably no appreciable magnetic attraction. The third precaution is important. We use 20 ft. of brass rods and so have no iron within 20 ft. of the compass. Tests with 10, 20, 30 and 40 ft. of brass rods at the same depth gave the same reading in a hole dipping 50 deg. N. 45 deg. E. so that 20 ft. is conservative.

Surveying in Magnetic Formations

When the rock formation is known to be magnetic, or when several tests with the compass do not agree, there seems to be no way of determining the course of a hole but by lowering the rods in such a way that the test tube can be orientated at any point in the hole. We have done this by the method suggested by Mr. Deacon. The rods are first screwed together in one or two long lines on surface just as they will be lowered into the hole, with the bronze case at the end, all the joints being made as tight as usual. Great care is necessary that no twist be left in the rods when screwing them together on the ground. This trouble is not experienced when there is snow as the rods slip easily on the snow and no torsion can be introduced. When the ground is bare it may be avoided by placing level planks at short intervals for the line of rods to rest upon and not allowing them to touch the ground at any point. If not over 500 ft. in length the rods will turn on grass without leaving any twist in the rods.

When all connected, each joint that is to be broken, usually every second joint, is marked with a chisel so that it can be screwed up again to exactly the same place. They are marked exactly on top as they lie on the ground so that when the rods are in the hole the marks will point in exactly the same direction. The joints are then broken, being careful not to disturb any joints which are not marked.

Dilute hydrofluoric acid is poured into a glass tube and the tube marked with a diamond and placed in the bronze case so that the mark on the tube corresponds with that on the case. The tube is then lowered into the hole, being careful to match exactly the marks at every joint. The mark on the last rod is placed directly in front of the drill and this direction determined, which is the direction of the mark on the glass tube. The tube is left stationary at the bottom of the hole for about 50 min. when acid diluted 12: 1 is used and then withdrawn and washed. To determine the course of the hole another mark is made exactly on the opposite side of the tube and the course found by using the goniometer and pro-

tractor as described in connection with the gelatin test.

This method, of course, only gives accurate results when the rods turn easily in the hole so that there is no twist in the rods when lowered. This is usually the case except in very deep holes or in holes where the inclination is low or where the curvature is excessive. In these cases, unless the hole is rifled, the twist may probably be removed by raising and lowering the rods several feet a few times after the rods are in the hole. Precaution should be taken that the tube cannot turn in the bronze case, either by wrapping with paper or by using a stopper which fits the case snugly. Our tests by this method do not always agree closely and are apt to be 10 or 20 deg. counter-clockwise from the course as determined by compass in a nonmagnetic formation. One reason for this seems to be that in lowering the rods the joints work tight or loose because of the friction of the rods revolving in the hole.

Cross-section of Drilling

For accurate location of drill holes cross-sections must be made through previous drill holes, preferably at right angles to the strike of the formation, showing the holes plotted according to the surveys for inclination and course, and showing the material encountered. We make these on cross-section tracing cloth, ruled in inches and tenths on a scale of 50 ft. to the inch. The sections may be superposed and compared, and the cross-section ruling makes it easy to read distances and areas without a scale. On these tracings the geological boundaries of formations and the outlines of orebodies are drawn in soft pencil, which prints satisfactorily but may easily be erased and changed if further drilling shows the first assumptions to be wrong. When necessary longitudinal sections are made and taken in connection with a plan and cross-sections give a good idea of the structure.

Deflections of Drill Holes

J. S. Curtis[3] gives an interesting theory of the cause of bore-hole deflections with results of experiments which he made to substantiate his theory. He endeavors to show that the influence of terrestrial magnetism should cause vertical drill holes to deviate to the north in the southern hemisphere and states that this is the case in the majority of holes, although the direction may be changed by the character of the country rock.

In our experience the latter feature is much the more important and from results of our drilling I should not say that the majority of drill holes deviate either north or south in all districts. If the strata are flat and uniform the holes may do so but if the strata dip steeply this is not the case. In one district where the dip is steep we are certain of the course of 14 holes which deviated from the vertical. Of these holes one went approximately north, one approximately south, one northeast, five northwest, one southeast and five southwest. Putting it in another way seven deviated to the north and seven to the south, while two deviated to the east and ten to the west. If these results show anything they only show that the majority of the holes deviated to the west, but equally to the northwest and southwest.

It is difficult to keep vertical diamond-drill holes straight and I believe that a hole can be located with more assurance of striking a certain point in depth if it is given an inclination of 85 deg. against a steeply dipping formation than if it is started vertical. We have only drilled two holes with this inclination, with results as shown in the following table.

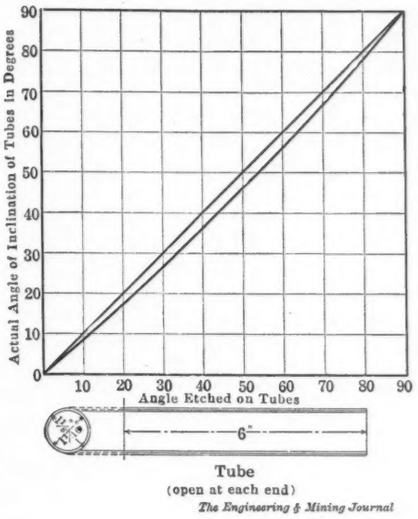

Fig. 5. Correction Curve for Capillary Error

These two holes are not enough to generalize upon but they certainly kept straighter than vertical holes in the same district. In addition to that we knew in which direction the holes were going,

Depth in Feet	Inclination in Degrees No. 1	No. 2
At surface	85	85½
At ledge	86	86½
200	86	
400	85	87¾
500	87½	
600	87	
800		88½
1200		85½

which we do not know when we start a vertical hole. I have published[4] a series of curves showing the curvature to be expected in an inclined hole when dipping against a steep jasper formation. I would change the curve for a hole started at 85 deg., as that seems to be a critical angle under these conditions and the hole does not flatten as would be expected.

In view of the sometimes surprising curvature of drill holes, I feel that all holes should be tested for both course and inclination at 100- and 200-ft. intervals, whether started vertical or at any angle, otherwise there is no telling where the ore or other strata cut are actually situated. We recently started a vertical hole which at a depth of 800 ft. was found to have an inclination of only 51 deg. from the horizontal. Another hole started at an angle N. 54 deg. W. was found to be running N. 64 deg. E. at the bottom.

Mr. Finlay's Michigan Report

The report of J. R. Finlay on the Michigan copper mines has seriously disturbed some holders of shares in these companies. In a recent interview in the Boston *News Bureau,* Mr. Finlay emphasizes certain features of his report; although most of these points were amply covered in the sections already published in the Journal, it may be of interest to report the interview below. Mr. Finlay said:

"In making my report, I had at my disposal the mine maps, records and other data which the various companies had compiled and it was largely from such sources of information that my report was constructed. The only seriously discouraging feature of the report to my mind was that, with the end of the Calumet lode in sight, there has not appeared in the great Lake Superior copper district any substitute to take its place in supplying copper or dividends.

"The Calumet lode, as I pointed out in my report, has to date produced two-thirds of the dividends paid by the Lake Superior copper mines but, of course, this could not go on forever. Because cold-blooded logic, which had not been applied in an appraisal of Michigan copper mines, was used as a basis for a determination of values, some of the mine officials have been somewhat startled at my findings.

"Some of the properties, including Tamarack, for instance, I valued at zero, for the simple reason that it had cost the companies in question on an average, during the last five years, more to produce copper than the average selling price for the metal, which I figured at 14c. per lb. The State could better afford to stand this valuation and take the chance of improving conditions at the mines than for the stockholders to have inflated ideas of the values of their properties. The Tamarack management entertains hopes of some day operating that mine at a profit. Time alone will prove this, but I include these 'hopes' in my report as matters of record and not as an expression of my own opinion.

"When I was commissioned to appraise the mining properties of Michigan I had in mind that both the iron and copper mines should be treated alike and their

[3] *South African Mining Journal,* June 11, 1910, and March, 1911.

[4] Eng. and Min. Journ., Sept. 17, 1910.

values arrived at on the same basis. It was not long before I found out that the stock market had greatly overvalued the copper properties, while the iron mines, owned by close corporations, had been taxed upon too low an assessment.

"In figuring valuations, the life and continuity of the deposit was the main question to be determined. There was no reason to expect that the various properties would soon play out except where the boundaries had been reached and depth had been sounded. In most cases the average depth was assumed. The Calumet & Hecla lode, for instance, was given a workable depth of 8000 ft. The extreme possible depth was not used, but rather the probable depth determined in the light of experience.

"In some of the mines the copper contents of the properties was arrived at on the basis of an average production per acre, while in others it was necessary to take into consideration the depth of the lode and the probable richness at great depth. The Pewabic lode, for instance, on which the Quincy operates, has proved conclusively that at depth the rock becomes poorer and poorer in copper yield."

"Is it not true," Mr. Finlay was questioned, "that the Michigan mine managements have never attempted to keep their ore reserves much ahead of production?" "That has been the case," replied Mr. Finlay, "hence my statement that the valuations placed on the properties exceed the known ore reserves."

Mr. Finlay does not believe that the death knell of Michigan copper mines has been sounded, for he admits that there are possibilities of improvement where now the situation looks the most dismal. Mr. Finlay's attention was called to the statement in his report relative to Calumet's conglomerate sands, in which he took the management's own figures of a recovery of 150,000,000 lb. copper from 30,000,000 tons of stamp-mill sands dumped into Torch lake, the value of which was disputed in the Ahmeek litigation.

Regarding this point Mr. Finlay says, "I had all the Calumet records on the subject, from which I ascertained that copper had already been produced from these sands at a cost of 5c. per lb. I assumed that the cost would increase to 9c. per lb., as the work of recovering the sands by means of dredges progressed."

Powder Trust Sued

A suit was brought against the E. I. du Pont de Nemours Powder Company, and a number of its subsidiaries, on Sept. 19, by the Buckeye Powder Company, of Peoria, Ill., alleging violation of the Sherman anti-trust law. The Buckeye company asserts that its business was injured by the methods of the so called powder trust and places its damages at $1,119,957, and asks for $500,000 punitive damages. It further asks that these damages be multiplied by three, as authorized by the Sherman act, making the maximum damage nearly five million dollars.

Roasting of Nickel Copper Mattes

The roasting of nickel-copper matte is a perpetually interesting problem, both because of the necessity of desulphurizing these mattes in order to produce commercial nickel, and also because of the theoretical ease and actual difficulty of a quantitative separation of iron, nickel and copper based on the decomposition temperatures of the sulphates.

Experiments on the roasting have recently been conducted by Edward F. Kern and H. W. Walter (School of Mines *Quarterly*, July, 1911.) Their general results may be summarized as follows.

The experiments show that in order to eliminate sulphur from a nickel-copper matte, the roasting must be conducted at temperatures above 600 deg. C., but below 700 deg., between which temperatures the desulphurization is rapid and the material is not rendered pasty. Above 700 deg. C., the particles consolidate, and unless vigorous rabbling is continuous, they will sinter, which retards the desulphurization. The sintering of the roasting material may be prevented by first carrying on the oxidation for about two hours at a temperature approximating 500 deg. C., during which time the particles will have been coated with oxides, then finishing the oxidation at and above 700 deg. at which temperatures the roasting proceeds rapidly.

Ferrous sulphate oxidizes to the basic sulphate at temperatures between 280 deg. C. and its decomposition temperature, which is about 580 deg. The higher the temperature, the more rapid the oxidation; and also, the higher the temperature above 580 deg., the more rapid the decomposition. Basic sulphates of copper are not formed by the direct oxidation of copper sulphate at temperatures below its decomposition temperature, which decomposition beginning at 647 deg. Above this, the breaking down of the sulphate occurs more rapidly the higher the temperature. Basic sulphates of nickel are not formed by the direct oxidation of dehydrated nickel sulphate, but form at temperatures above its decomposition temperature. Nickel sulphate begins to decompose at 727 deg., and takes place rapidly above 736 degrees.

Cuprous sulphide freezes at 1110 deg. C. Nickel sulphide, of the composition corresponding to Ni_3S_4, freezes at 790 deg. A mixture of 64 parts of Cu_2S and 36 parts of Ni_3S_4, begins to solidify at 948 deg., where the excess Cu_2S separates, after which the eutectic freezes at about 740 deg. A mixture of 50 parts of Cu_2S and 50 parts of Ni_3S_4 begins to freeze at 900 deg., where the excess of Cu_2S solidifies, and at about 740 deg. the eutectic freezes. A mixture of 40 parts of Cu_2S and 60 parts of Ni_3S_4 is the eutectic; it freezes at about 740 degrees.

Mattes, produced by smelting nickel-copper ores, contain the nickel in the form of the subsulphide Ni_2S. These mattes, when "blown" to almost complete elimination of the iron sulphide, contain an alloy of nickel and copper of composition of these two metals in the proportion in which they existed in the matte.

In this connection D. H. Brown's conclusions on "The Behavior of Copper-nickel Mattes in the Bessemer Converter[1]" are appended. These are: (1) Nickel is not an element replacing iron in mattes. (2) Nickel-copper alloys act in the matte blow like one metal. (3) Nickel-copper alloys follow, during the matte blow exactly the same laws as govern the behavior of copper alone. (4) Nickel does not, as previously supposed, follow iron into the slag, but displays a reluctance to part with the copper, so much so that one pound of nickel passing into the slag drags 1¼ lb. of copper with it. (5) While nickel during the last of the blow does oxidize, yet it lags behind sulphur as a heat producer. It is impossible to blow all the nickel out, about 2 per cent. is always left in the finished copper. (6) The final product of blowing a copper-nickel matte is one homogeneous metal, no matter whether high copper and low nickel, or *vice versa*. (7) The nickel exists in the matte as the subsulphide Ni_2S, and not as the monosulphide NiS.

Cherry Creek Gold

DENVER CORRESPONDENCE

For upward of 50 years gold has been found in the sands of Cherry creek which flows through Denver into the Platte river, but its source was never found. Lately some prospectors discovered a dike of porphyry outcropping at the head of Newlins gulch which empties into Cherry creek near Parker on the Colorado & Southern railway. The porphyry is stated to assay well in gold but has not yet been sufficiently explored to determine its average yield. The gulch below it is the scene of considerable excitement and men with rockers and sluice boxes are said to be making good wages, one man with a pan, pick and shovel alone being credited with a recovery of $10 per day on a 10-acre tract. Some Denver men have secured a lease on 300 acres and will thoroughly test it with drill holes, and if the returns warrant it they will install a dredge. These placers are 35 miles southeast of Denver.

[1]*Trans.* A. I. M. E., 1910.

Appraisal of Michigan Mines—III

By J. R. Finlay *

For convenience, iron ranges were divided into districts. Method of appraisal similar to that for copper. Fixing of price for iron ore is a complicated process.

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Unlike copper, no specific figure can be given for the value of iron. The price of the ore varies according to its chemical and physical qualities. The expected future price of ore has been fixed for the purposes of this report on a calculated value for all grades based on the average quotations for standard ores for the last seven years. As a matter of fact the average for seven years differs little from the average of the last five years.

Value of Iron Ore

These standard prices are fixed annually by the Lake Superior Iron Ore Association. The methods of figuring the price of ore from analysis is fully described in the handbook by Crowell & Murray[1]. It is also explained in Rukard Hurd's Iron Ore Manual of the Lake Superior district[2]. On account of the rather complicated nature of these calculations they are not described in this summary, but the average price received and the average price expected for the ore of each mine may be found in the tables of figures.

The question arises whether the average price for the last seven years is a fair one for the future. As in the case of copper, the prices ruling for the season of 1911 are lower than the calculated average used. The considerations that impel me to use this average are precisely the same as those used in the case of copper, there being the same reasons to expect a continuance of the demand in the one case as in the other. The growth of the iron-mining industry in the Lake Superior region shows some startling figures. The demand has been doubling every 10 years. The shipments in 1910 from the whole region were 43,350,715 tons; in 1900 they were only 20,593,570 tons; in 1890, 9,003,801 tons; in 1880, 1,908,754 tons. While the shipments of one year occasionally fall behind those of the preceding year, it seems to me that no one can expect this prolonged and rapid growth to come to a sudden stop. To be sure the resources of the region are sufficient to maintain an output of 40,000,000 tons per year for 40 years, taking only ore that is merchantable under present conditions so that at recurrent intervals the market may be gutted. But if the demand continues to increase in anything like the proportion that has ruled during the last 30 years, these known reserves will be exhausted in a much shorter time. At least three-quarters of all these reserves have been put in sight by the exploration of the Mesabi range in Minnesota during the last 20 years. The discovery of new ore in that district has almost ceased, and it is to be expected that from now on the already known orebodies will be in a progressively firmer commercial position. It is conservative to say the amount of new ore discovered in the Lake Superior region each year is not now more than keeping pace with the depletion of reserves. It is also probable that the progress of discovery is now proportionately more rapid in Michigan than in Minnesota.

Michigan has lost to Minnesota her former commanding position in the iron-ore trade. In 1880 Michigan produced all of the iron ore shipped from Lake Superior; in 1890 it shipped more than 90 per cent.; in 1900 approximately 50 per cent.; in 1910 less than 30 per cent. In spite of this proportionate loss, the tonnage shipped by the Michigan mines has steadily increased and may be expected to increase.

Possible Effect of Foreign Competition

For the first time in many years, some of the Lake Superior iron producers are expressing uneasiness as to the effect of competition of iron ores from Cuba and Brazil, especially in view of the probable abolition of the tariff on iron ore. In Cuba there has been developed a reserve of iron ore amounting to 3,000,000,000 tons, all lying close to tidewater. The ore presents some disadvantages, being high in moisture, so that while the dried ore runs over 50 per cent. in metallic iron in its natural state, it contains less than 35 per cent. This fact presents some metallurgical difficulties which cost money to overcome. At present the ore is put through a process of "nodulizing," before shipment, at a cost of $1 per ton. The cost of mining and shipping to the coast is expected to be small, the ore being really nothing but a ferruginous clay, forming a bed from 10 to 80 ft. thick on the surface of the ground, requiring no stripping or any preliminary work except to clear away the brush. It is said that this ore can be utilized without the "nodulizing" process, in which case it could probably be delivered at New York or Philadelphia at a cost of $1.25 per ton. At present, however, the nodulized ore must cost well over $2.25 per ton at our Atlantic ports.

Brazil also has a tremendous field of high-grade bessemer iron ores, running 65 to 68 per cent. metallic iron. The field is, however, entirely undeveloped. It is situated three hundred miles inland from the ports of Rio Janeiro and Victoria and is reached by a railroad, but the railroad is such a poor one that it cannot be seriously used as a vehicle for bringing the ores to market. It appears that these ores might some time be delivered in Europe or the United States for a cost of about $3 per ton. Lake Superior ores of the same grade would cost over $5 per ton at Lake Erie ports and over $7 per ton on the seaboard.

Cost of Lake Superior and Cuban Ores

I am satisfied, however, that competition from these fields can do nothing more than to curtail the rate of expansion of demand for the Lake Superior ores. It will not prevent shipments from continuing at the present rate or even from greatly increasing. I base this opinion on a very simple fact, viz.: that the costs mentioned for Cuban and Brazilian ores are not given upon the same basis as those for Lake Superior ores. In the case of Cuba and Brazil the costs talked of are the bare operating costs, without any allowance for taxes, royalties or profits. A nodulized Cuban ore at the seaboard should be compared with a Lake Superior ore of the same grade at Cleveland on the same basis of cost. Admitting that 52 per cent. Cuban ore costs without taxes, royalties or profits, $2.25 per ton on the Atlantic coast, let us see what the Lake Superior ore will cost on the same basis.

The United States Steel Corporation could deliver its average Mesabi ore at Cleveland for $1.50 per ton. From its best mines it could deliver such an ore for $1.10 per ton. It could deliver ores mined underground from the Vermilion range for less than $2 per ton. The whole product of the Gogebic range in Michigan can be delivered at Cleveland at an absolute cost not exceeding $2.35 per ton, and large tonnages for $2.15 per ton. A large tonnage can be delivered from the Marquette range of Michigan for $2 per ton. Large quantities of ore can be delivered from the Crystal Falls and Iron River districts for $1.75 per ton. It is evident from these figures that the advantage of the Cuban ores is more apparent than real. No one is going to mine Cuban ores without paying taxes or without expecting profits. There are the further disadvantages of having to secure and invest a large capital to pro-

[1]Penton Publishing Company, Cleveland, O.
[2]F. M. Catlin, sales agent, St. Paul, Minn.

vide facilities for shipping the Cuban ore at all. This disadvantage is much more pronounced in the case of Brazil.

I do not argue from these considerations that either Brazilian or Cuban ores will not be used for making steel on our eastern coast, for I think they will, but I am satisfied that their effect on prices will be absolutely *nil* and that it will be a long time before their competition will be even felt in the region now supplied with iron from the Lake Superior mines. At the most the foreign ores will affect the trade only on the seaboard. There is nothing in sight to challenge the dominance of the Lake mines in the whole interior of North America.

Effect of Tariff on Iron and Steel

The same reasoning that applies to foreign ores applies to foreign manufacturers in iron. They cannot come from inland. One consideration which is often forgotten is that the United States produces annually more iron than England and Germany together. "The tail cannot wag the dog." The gigantic, thoroughly organized and established iron industry of the United States cannot be overthrown or even seriously deranged by the surplus of Europe. The only probable effect of taking off the tariff altogether would be to prevent prices from going unduly high in boom times and to divide the markets along the coasts. The iron made from Lake Superior ores will have an undisputed field from the Hudson river to the Rocky mountains, and from the Ohio and Rio Grande to the Arctic ocean.

I believe these statements can hardly be seriously disputed and I recite them as reasons for my belief that the iron ore market will continue in the future on substantially the same course it has pursued in the past; that the demand is sure to increase, and that the prices are more likely to be higher than they are to be lower than the average of the last seven years.

Royalties and Taxes

A large proportion of the iron ores are produced from leases, which usually have long terms, so that they might properly be called leaseholds. A majority of the operating companies pay royalties to fee owners and these royalties are to those operating companies a genuine and unavoidable expense. It is probably a uniform custom to make the holder of a lease responsible for all taxes on the lands he leases. It seems hardly fair in view of these facts to assess the operating companies on the royalties which they pay, because from their point of view the royalty is an expense and not a profit. But in answering the plain question which the board asks, viz.: "What are these properties worth?" I cannot do otherwise than to consider royalties paid as net profits. The amounts of these royalties are in every case tabulated, together with the ownerships of the fees to which these royalties belong.

You will find in the various tabulations of costs and values that taxes are treated wherever reported as a separate expense and that the proportion of these taxes to operating profits is given. In making appraisals I have allowed each company under the head of "General Expense" as a portion of the mining cost the average amount of taxes they have paid per ton during the last five years.

Tabulation of Costs

The iron mines of Michigan are usually described as occurring in three "ranges"—the Gogebic, Marquette and Menominee, but for the purpose of showing the facts in the most intelligible manner, they have been divided into groups, different from the usual classification. Our groupings are determined essentially upon a basis of comparative uniformity of geological occurrence, which necessarily determines the economical factors of cost and value as follows: District No. 1, the entire Gogebic range in Michigan, Gogebic county; No. 2, Iron River district, Iron county; No. 3, Crystal Falls district, Iron county; No. 4, old Menominee district, Dickinson county; No. 5, Western Marquette range, Baraga county; No. 6, Marquette hard-ore mines, Marquette county; No. 7, Marquette soft-ore mines, Marquette county; No. 8, Swanzy district, Marquette county; No. 9, various scattered low-grade, silicious mines, which produce ore under exceptional circumstances and which have a limited market.

The results are presented in a separate tabulation for each of these districts. These tabulations show for the last five years the total expenditures, the production and receipts from ore, the ore reserves reported, the total ore reserve counted on the calculation of the average value of ore from the grades reported in the ore reserves, the expected cost for the future based on a study of costs ruling in the past, and a valuation of each mine indicated by all the facts. It is well to explain that the cost statements will show some inevitable differences in detail. Until all the mines keep their books in exactly the same way, this is to be expected, but on the whole the variations are not very great. They mainly arise from the fact that one company may charge its expenditures for certain kinds of construction directly to mining, while another company might put such expenditures into a separate account, calling it "construction." In the same way, there are certain variations in amounts charged to general expense, explorations, etc. The student of mining costs will have no difficulty in seeing what the statements mean in each case. The title "Explorations" in the cost statements usually refers to a general campaign of search for ore by some of the larger companies. This work may or may not be on lands owned by the company. It is a practice to take options on likely pieces of land and spend money for geological research and explorations by drilling or test pitting. I have thought it fair to allow the companies who conduct their business in this manner for the cost per ton of all this work. It is spread uniformly over the tonnage produced by all the mines of such operating companies for the last five years. I assume, also, that this expense will be continued and, consequently, allow the same charge in my estimates for future cost.

General Data on Value of Mines

In comparison with the copper mines, the situation of the iron mines is distinctly more favorable. Several considerations contribute to this.

(1) They are not facing any considerable deterioration in the metallic contents of their ores, nor are they facing the depending exhaustion of any commandingly important property. The probable downward limit of ore occurrence is nowhere in sight.

(2) The condition of their ore reserves is excellent, and this points to a continuance of production, with almost absolute certainty for a period of 25 years in advance.

(3) In contrast to the paucity of discoveries in the copper country, many new deposits have been discovered within recent years, so that in addition to the continuance of the present mines, there is reason to expect that new ores will continue to come in.

(4) The actual earnings of all iron properties in the five years under review were $57,400,000. These are net profits over and above all expenditures, including the purchase of new equipment, many outside explorations and taxes. The copper mines earned $50,000,000 in the same period, but by far the greater part of this was earned during the years 1906 and 1907, when copper was abnormally high. Calculating on a normal price the earnings would have been only $41,200,000. In the case of iron mines the prices, and consequently the earnings, for the last five years were practically normal.

The actual ore in sight is sufficient to guarantee the production and earnings on the same basis for 16 years. Without going further than this we can find reason for giving them a valuation of $115,000,000. But it is practically as certain that the production can be maintained for 25 years as that it can continue 16 years. With such a life the mines would be worth $150,000,000. I am convinced that they are worth this amount, but, for two good reasons, it will be impossible to apportion the values among the various mines in order to bring them up to this total: (1) Because it is much

easier to be sure of the endurance of a whole district than for a circumscribed tract covering a small part of the district. (2) Important occurrences of ore are sometimes divided in ownerships in such a way as not only to diminish the probable profit to be obtained from them, but also to throw doubt as to the proportion belonging to the different owners. Both these factors are constantly in evidence in all the districts.

Estimating Ore Reserves

Calculations of ore reserves are based on three elements: (1) Ore found in drill holes. In practically all cases we have been compelled to estimate this ourselves by the simple method of measuring the area which the drill holes seem to demonstrate to be occupied by a continuous orebody, and multiply this area in square feet by the average thickness of ore shown in the holes of the group. The number of cubic feet thus calculated gives the tonnage by dividing by the number of cubic feet representing a ton of ore in the district to which the orebody belongs.

There is some latitude for the exercise of judgment in determining the area to be considered as demonstrated, but in no case have we taken areas greater than can be obtained by drawing lines 50 ft. outside of holes in ore. (2) Ore reported by companies as being in sight above bottom levels of their mines. (3) An additional amount of ore, based on my own judgment of what is reasonable, for extensions below the bottom levels.

Since all of these calculations are based upon documents submitted by the companies themselves, it is plain that only one element in the estimates on expected tonnage is open to serious dispute, viz., the extent to which my judgment may be in error in assuming the extensions. Only a portion of this element can be open to question, because it is patent that there must be some extensions.

District No. 1. Gogebic Range

In this district no ore whatever is indicated by drill holes. We have to consider the following facts: The ore formation consists of a narrow band of ferruginous rock about 800 ft. thick inclined to the north at an angle of 70 deg. and extending 15 miles in Michigan from the Montreal river to a point east of Wakefield.

The accompanying table shows the amount of ore shipped by these mines up to the end of 1910 and the amount reported in sight above the bottom levels.

To the figure of 71,817,000 should be added 3,600,000 tons additional for a correction, which I will not take time to explain, giving a total showing of 75,400,000 tons above the average bottom level which is 1450 ft. deep.

Good Showing on Bottom Levels

Now, we find that on the bottom levels there is exposed in this range a total area of 662,000 sq.ft. of ore avoiding all duplicate sections of any orebody and, since 10 cu.ft. will make a ton, this is equal to 66,000 tons for every additional vertical foot. Working this back toward the surface, we find that the depth of 1450 ft. would mean more than 90,000,000 tons instead of 75,000,000 tons accounted for. In other words, the showing of ore on the bottom levels is actually better than the average of the mines during their past history. Furthermore, the deepest of the mines is 2140 ft. deep, being 700 ft. lower than the average. At this depth the showing of at least one orebody is magnificient and it will surely go much deeper. With these facts in view no intelligent mining man will disagree with the opinion that large additions to the measurable reserves are absolutely called for before any adequate figure for the valuation of the mines can be reached. It is perfectly rational to expect them to produce as much ore in the future as they have in the past. However, I have been cautious in assuming great extensions.

DISTRICT NO. 1. TONNAGE TABLE

	Tonnage Shipped to End of 1910	Reported in Sight	Total Above Present Bottom Levels
Ashland	5,618,390	197,000	5,815,390
Norris	25,385,930	9,361,500	34,747,430
Newport	7,027,363	5,475,000	12,502,363
Puritan	159,590	50,000	209,590
Ironton	958,910	130,000	1,088,910
Yale	481,426	0	481,426
Colby	2,645,101	815,800	3,460,901
Tilden	5,188,572	404,500	5,593,072
Anvil			
Palms	2,058,868	379,000	2,437,686
Eureka	503,745	65,000	568,745
Asteroid	0	10,000	10,000
Mikado	1,049,800	20,000	1,069,800
Chicago	68,727	184,000	253,427
Brotherton	1,855,124	95,500	1,950,124
Sunday Lake	1,422,461	150,000	1,572,461
Castile	55,444	1,000	56,444
Total	54,479,269	17,338,300	71,817,769

Norrie Mine

The property is two miles long. One section at the west end is developed down to the vertical depth of 1592 ft. Along the central section of the bottom level is approximately 1200 ft. and toward the east end 1445 ft. We may say that this mine is developed to an average depth of 1400 ft. Above this level there are reported in sight 9,361,500 tons of ore. One great orebody at the east end of this property is developed to a depth of 1445 feet.

It is known to be the same orebody which has been developed in the neighboring Newport mines to the east to the additional of 388 ft. The area of the Norrie in this body is 182,000 sq.ft. In the Newport on the 1940-ft. level the area is 306,000 sq.ft. The average of these two sections is 244,000 sq.ft. This gives a volume of 9,467,000 tons of ore between these two levels, of which 7,200,000 is accounted for and the remainder 2,271,000, is to be added to the Norrie. This whole amount has to be added to the ore reserves reported, being the total of assumed ore up to over 11,600,000 tons.

In the central and western portions of the mine there is exposed a total area of 205,000 sq.ft. of ore at the bottom, of which 195,000 sq.ft. are only developed to the 1200-ft. level. The smaller orebody is just entering the property at the extreme west end at a depth of 1592 ft. If the great central orebody goes down merely to the depth demonstrated for the smaller western body, it will yield 7,000,000 additional. If it goes down to the depth to which the eastern orebody is developed on the Newport, 2140 ft., it will yield an additional 16,000,000 tons. But for our purposes I only add a modest 6,400,000 tons for the continuation of these bodies, bringing up my total estimate for the Norrie to about 18,000,000 tons, which are sufficient to last the mine at the rate of its average sales for the last five years, for 70 years. It is almost needless to say that this estimate is moderate and undoubtedly below the expectations of the owners.

Newport Mine

This is the deepest mine, not only on the Gogebic range, but in the whole Lake Superior iron region. It is now working principally upon a great body of ore which has descended into it from the westward through the Norrie property. Above the 2140-ft. level there is reported in sight, 5,475,000 tons. To this can be added, with absolute confidence, 3,600,000 tons, merely by assuming that the developments on the 2140 level will show the ore to be as large on that level as it is on the 1940 level. This development has already progressed enough to demonstrate it as a practical certainty. This makes our estimate 9,000,000 tons assured.

The question remains how much ore should be allowed below the 2140-ft. level. An assumed extension of 270 ft. additional depth would give us 8,000,000 tons. Another assumption based on the possible termination of the orebody against a certain dike about 1000 ft. to the eastward of the center point of the present orebody gives approximately the same estimate, viz.: 8,000,000 tons. If we use this we might assume a total of some 17,000,000 tons for this property. This is entirely reasonable because it is based only on one orebody. The Norrie mine shows two other large orebodies below the one on which the Newport is working, and both pitching eastward into the Newport property. Absolutely nothing is known about the depth to which this mineralization may extend. I am satisfied that an expected life of 20 years or 800,000 tons per year will not meet with serious dissent on the part of the owners.

Other Mines on the Gogebic

It will be noticed that the Norrie and Newport together have shipped 60 per cent. of the whole output of the district. They are credited with 80 per cent. of ore reserves. During the last five years they have made 75 per cent. of the profits of the district. These comparisons are more than reflected in the valuations put on mines, the Newport and Norrie together accounting for approximately 84 per cent. of the valuation. I am satisfied that this proposition for the Newport and Norrie is too high and too low for the others. But it is not on the whole unfair to the operating companies because the Norrie mine is owned by the Oliver Iron Mining Company, which also controls the Tilden, Puritan, Geneva, Davies and Chicago properties. These mines cover an important part of the range outside of the great central orebody, but in all cases I have given them either no value at all or merely a nominal value because the ore reserves are small and the costs have been high. The Newport Mining Company controls, besides its main mine, the Anvil and Palms, on which an exceedingly promising orebody has been found. It will probably prove to have a much higher value than I have given it. The other mines are given tonnage somewhat in proportion to their past records.

Colby, Ironton, Mikado, Brotherton and Sunday Lake Mines

The Colby mine I am crediting with an expectation of 1,500,000 tons to be mined in 10 years. This property has shipped in the past 2,645,000 tons and reports 815,000 in sight, making a total of 3,460,000 tons. The mine gives no indication of being bottomed or worked out, and I have added for extensions of its present orebodies 20 per cent. for ore yet undeveloped. I am satisfied that it will produce more. The Ironton mine has shipped 958,000 tons and reports in sight 130,000 tons, giving a total of 1,088,000 tons. It has recently cut an orebody in the north formation, which from its position is probably important. I think it reasonable to assume, therefore, that the mine will develop ore equal to a third of that it can account for at present. The Mikado mine has shipped 1,050,000 tons and reports 20,000 in sight. Since this mine shows no indication whatever of playing out, I think it reasonable to assume that it will produce 500,000 tons more, largely because it is improving in the bottom after passing one or two rather poor levels. The Brotherton and Sunday Lake mines together account for more than 3,500,000 tons of ore. They are worked on the same orebody which seems to be pitching to the eastward. It shows remarkable continuity and is improving. The bottom level 1068 ft. deep in each shows a continuous body of ore 1700 ft. long with an area of excellent ore 61,000 sq.ft. It is divided about equally between the two properties. This is equal to 6000 tons per vertical foot. I think it fair to assume that this orebody will produce 2,500,000 tons at least. On account of the pitch toward the Sunday Lake mine, I give that property three-fifths of this expected tonnage.

Reserves of the Gogebic Range

For the district as a whole. it will appear from the table that I have seen fit to increase the tonnage reported in sight from 17,400,000 to 46,400,000. Of this increase I consider 11,000,000 tons to be practically demonstrated, bringing the total of demonstrated ore up to 28,400,000. I am assuming 18,000,000 tons more for extensions of the principal orebodies beyond their present bottom levels. This means an extension of less than 300 ft. in depth and increasing their present depth only 20 per cent. A high average grade and consequent high value of the ore of district No. 1 makes the value of its mines higher than the other districts, in spite of the fact that the expected tonnage is less than in some of the others. The total valuation of the group is $41,560,000, based on an expected future product of 43,000,000 tons and an annual output of about 2,900,000 tons.

(To be continued)

DISTRICT NO. 1. GOGEBIC COUNTY

	Per Ton	Totals
Number of mines and explorations reported		20
Wages and salaries paid		$16,632,296.40
General expenses (not including taxes)	0.098	$ 1,558,705.93
Construction, development and explorations	0.260	4,083,864.20
Mining expense	1.355	21,207,105.10
Total cost at mine	1.72	26,849,675.23
Rail, freights paid	0.40	6,002,288.37
Lake freights paid	0.71	10,585,921.64
Commissions paid	0.046	695,520.57
Total expense	2.876 (a)	$44,133,405.81
Total tons sold		15,183,842
Total tons shipped		15,393,642
Total tons mined		15,711,053
Receipts from sale of ore		$65,694,536.07
Total operating profit of 12 mines		21,944,683.57
Taxes		992,272.42
Proportion taxes to operating profit, per cent		4.55
Royalties		5,960,403.65
Profit to companies (12 mines)		15,212,854.39
Total profits, 12 mines, including royalties		20,957,419.53
Total loss to three mines (explorations and developing properties not included)		678,579.85
Total tonnage reported in sight		17,354,100
Tons added by appraiser		25,645,900
Total tonnage expected		43,000,000
Average expected value per ton per year		$4.22
Average cost per ton expected		2.87 (a)
Average profit per ton expected		1.35
Annual tonnage expected		2,875,000
Present value of mines		41,560,000.00

(a) F.o.b. Cleveland. The average cost per ton includes mines worked at a loss. The expected cost per ton is only for mines expected to work at a profit.

The Giesecke Tube Mill

Johannesburg Correspondence

The local press has lately teemed with laudatory articles giving an account of the Giesecke tube mill by which it is claimed that an industrial revolution may be produced in our milling plants. At company meetings and semi-social gatherings quite an encouraging vista of possibilities of displacing the stamp mill has been opened up and described. The mining editor of the Star reports that according to the tests now being carried on at the Geldenhuis Estate this large tube mill is crushing 360 tons of ore per day to a pulp about 81 per cent. of which will pass through a 200-mesh screen.

Even allowing that it is a much superior machine to the ordinary tube mill for ore-crushing purposes, which by the way has not been established yet, those who have had experience with the actual working of tube mills must be excused if they prefer to await the results of the tests now being conducted by the Mines Trials Committee of the Chamber of Mines before placing any credence on the remarkable performance of this machine as described by the journal already referred to. This new tube mill is understood to have worked well for some time in connection with cement manufacture but, of course, there are some fundamental differences between grinding for cement manufacture and the extraction of gold.

Mill Has Two Divisions

The appearance of the mill is much the same as that of the ordinary tube mill working on the Rand save that it has two different sized divisions, one 7 ft. 6 in. diameter by 6 ft. long, the other 6 ft. diameter by 18 ft. long. The ore is first crushed to seven-inch cubes and then fed into the larger portion of the mill which is separated from the smaller portion by a dividing plate with ¾-in. perforations the object of which is to keep the large-diameter portion engaged on a first-stage grinding operation.

On the inside of the mill are projecting plates described as liners about two feet long by one foot wide and two inches thick. Instead of flint or rock pebbles for grinding purposes steel balls varying from one inch to four inches in diameter and weighing altogether over 20 tons are used. The larger steel balls are used in the larger portion of the mill where the feed is introduced. At the exit end of the mill steel arms to act as mixers are attached and it is not until this stage of crushing is reached that the cyanide solution is introduced.

The gross weight of the uncharged mill is about 70 tons, which includes the steel balls, the liners and the tube itself. The charge weighs about 50 tons. The mill with its charge is driven by nearly 300

h.p. at a speed of 24 r.p.m. From the standpoint of a mechanical engineer the most meritorious feature of the mill is its arrangement for automatic lubrication consisting of grease boxes fitted over the bearings charged with Canadian grease and not requiring attention for long periods. It is claimed that the capacity of the mill is equal to 50 stamps with two ordinary sized tube mills thrown in and that the cost of the mill alone is only about £6000. Another important advantage claimed for the mill is that the pulp need only be moistened with water to the extent of 28 per cent., this being at least 10 per cent. less than the percentage used in the ordinary tube mills.

Tests with regard to the efficiency of this new appliance were started about three months ago but beyond the results published by the mining editor of the "Star" previously referred to, no official statement of the results has been made public more especially with regard to its efficiency and maintenance costs which after all are the most important. Judging, however, from the stoppages which have taken place apparently for the want of spares for the wearing parts of the mill the cost of maintenance must be somewhat higher than the inventor anticipated otherwise spares would have been kept on hand and immediately available.

Use of Steel Balls Costly

Engineers with tube-milling experience will naturally regard the use of steel balls with considerable suspicion as they must be liable to considerable wear, while their renewal must be costly, ranging between one and two shillings per ton treated. Tube-milling engineers would naturally prefer to use flint or rock in a machine like this in place of steel balls, for it is likely that steel balls would have been used in the ordinary tube mill had previous experiments with them proved satisfactory. Then, again, the use of as low a percentage of moisture as 28 per cent. of the pulp does not seem to harmonize with the best tube-milling practice on the Rand, where 38 per cent. is perhaps as low as most milling engineers for obvious reasons would care to use.

The statement by the mining editor of the "Star" that the mill is crushing 360 tons of ore daily and producing an 81 per cent. pulp through 200 mesh is one that those with any practical knowledge of tube milling will hesitate to believe. At all events they would consider that an average of 60 per cent. through 200 mesh would be much nearer the mark with a duty under 300 tons a day rather than over. This opens up the important question as to whether this Giesecke tube mill can be regarded as a likely appliance to reduce crushed ore to the necessary fine pulp at one operation.

If, as is possible, the mill can only be relied upon to reduce 60 to 70 per cent. of the feed to the necessary fineness and the coarser pulp has to be returned to the tube, then the duty must suffer because two-thirds of the pulp will be overdone in order to reduce the other third to the necessary fineness because years ago it was shown that it was unnecessary to produce a pulp finer than would pass 200 mesh. A better alternative would perhaps be to treat the coarser pulp in a separate tube mill, but here again the Giesecke tube mill will lose its claim to being able to reduce the Rand ores to the necessary fineness at one operation. Nevertheless, even with a supplementary tube mill, it might be considered an improvement on present-day methods more especially if it brings about such a large reduction in capital outlay.

Until the Mines Trials Committee reports the result of the experiments now in progress with the Giesecke mill at the Geldenhuis mine nothing, of course, will be known as to the actual results of the experiments. Too much reliance must not be placed on the newspaper reports with regard to the probable passing of the stamp mill. Any reliable milling engineer on a personal inspection of the mill at work, which is readily granted, will see that in the use of the steel balls the cost of maintenance must be necessarily high as also the general wear and tear. Perhaps some method of overcoming this drawback may in the end be found.

It must not be overlooked that the new Roodepoort United Ore Reduction plant is expected to treat the ore at a total cost not exceeding 2s. 6d. per ton, which at all events is a low cost for the Rand. From a cursory inspection of the Giesecke mill, however, when maintenance costs are included it does not seem possible to approach this figure and the question arises as to what extent it is advisable to sacrifice reliability and working costs to save capital outlay. These questions can only be decided by the experiments now in progress.

Germany's African Diamond Fields

The sanguine prospects of the diamond fields in German Southwest Africa in the early days of their exploitation about five years ago are not being realized, according to Consul-General T. St. John Gaffney. The reason given is that the surface of the diamond region, which previously supplied large quantities of the gem, has practically been cleared of its rich harvest, and deeper mining, with its attendant greater cost, must be resorted to.

The Colonial Mining Company, which, in its infancy, paid the magnificent dividend of 2500 per cent. on a capital of about $100,000, has long come down to less figures. The Kolmanskop Society, which paid 55 per cent. in its first year and 45 per cent. in its second, now announces a dividend for the half year of 15 per cent. The German Diamond Society paid 10 per cent. last year and 5 per cent. this, while the Lüderitzbucht Combined Companies paid no dividend last year. In addition to the need of costlier methods of production is noted a shortage of labor and a high export tax of 33⅓ of the gross value. It is not considered, however, that the diamond supply is near exhaustion.

Potential Mineral Resources of Maine

That Maine is a State of great undeveloped mineral resources is the substance of a recent paper by C. Vey Holman, retiring State geologist, before the American Electrochemical Society. He believes that Maine's harbors and water powers form the basic factors needed for great electrochemical development, which will then react on the mining industry.

Concerning the mineral resources he says in part: The iron ores of the Mount Katahdin region, which for several decades furnished an output of high-grade of charcoal iron for a single blast furnace, are of unusual character in their freedom from sulphur and phosphorus. There is a belt of hematite ores extending northeast through several Aroostook county townships, ending in the well known deposits of Woodstock, New Brunswick, which, with the development of the Aroostook water powers and the use of the electric furnace, may be counted upon as a future commercial source of supply, lime and other fluxes being at hand within convenient distance. The feldspar deposits of the State are well known and are increasing in output, and in connection with their development gem mining is assuming considerable importance in the production of tourmalines of the highest quality.

At Catherine Hill in Hancock county, there is now under development what is believed to be the largest deposit of molybdenum sulphide in America. There is exposed a large tonnage of molybdenite, averaging 2 per cent. MoS_2 in a granite matrix which carries also gold and silver, which are of commercial importance as a concentrating ore. Silver-lead zinc ores are abundantly found, but have been sparingly worked, owing to inherent difficulties which, in the past, rendered their reduction difficult and unprofitable; but these should furnish prosperous industries through electrostatic separation and electric-furnace smelting. Maine copper deposits are extensive though not worked and at various points in the State the occurrence of small bodies of tin ores supports the belief that some time there will be discovered a tin deposit of commercial importance. The quarries of granite, lime and slate are too well known to need further comment.

The Wislicenus Smokestack

By O. H. Hahn*

A method of stack construction which results in a greatly accelerated mixing of the waste gases with air. Sides of stack contain a great number of openings.

NOTE—Translated from *Zeitschrift* des Vereines Deutscher Ingenieure, June 10, 1911.

*Metallurgist, Schillerstrasse 6, Jena, Germany.

In an out-of-the-way corner of the Dresden Hygienic Exposition, now going on, is a collection of objects relating to damage by smoke; among them are drawings and models of a chimney with a novel top. This chimney is the design of Doctor Wislicenus, professor in the academy of forestry at Tharandt, 14 miles east of the reduction works at Freiberg, Saxony, and is called by him a lattice chimney.

Doctor Wislicenus explains the advantages of the chimney substantially as follows: Smoke consists of visible solid matter and invisible gases. While the solid matter (soot and flue ashes) is particularly injurious to the lungs of man and beast, and renders buildings dirty both inside and out, the acid gases of the smoke cause considerably greater damage to plants, especially to the sensitive resinous trees. Experiments made with soot demonstrate the fact that it does not injure plant life. Benzol soot deposited directly on delicate leaves and left there did not produce any damage. Soot made up with water and sprayed on leaves produced only slight lesions, and even soot extract, leached with water and alcohol, would cause only the tenderest parts of the leaves to wither at the rim, or produce stains.

LIMIT OF SO_2 FOR SPRUCES, 0.0002 PER CENT.

Investigations in the direction of the smoke acids, such as sulphurous, sulphuric, hydrofluoric, hydrochloric acid, etc., led to the establishment of a minimum of noxiousness which, in the case of the sulphur acids and the most sensitive of resinous trees, the spruce, is at the density of one part SO_2 per 500,000 parts of air, or 0.0002 per cent. by volume or 0.0071 gram SO_2 per cu.m. This seemingly infinitesmal minimum for the acid is also corroborated by observations according to which resinous trees in the atmosphere of large towns are at the limit of the conditions of existence, even if well cared for, and have to give way in the smoke-laden air of industrial localities. Analyses of air in towns have yielded in the order of their sizes acid approximating the above figure; for example, the air at Berlin, 0.000035 per cent. by volume of SO_2; London, 0.00039; Glasgow, 0.00042; Cleveland, as much as 0.0021; smaller English towns, about 0.000031 per cent. by volume.

Compared with these values the acid contents of all industrial smoke sources appear immensely high. Even the ordinary bituminous-coal smoke, with an average of 0.05 per cent. by volume and with about 1 per cent. volatile S in the coal, appears to be concentrated about 100 times too high. Other industrial-smoke sources are, according to the compilations of the lecturer, many thousand times too high in acid contents (e.g., the waste gases of a glass factory using the sulphate process, 886 times; of a smalt factory, 1000 to 7000 times; the waste gases of the roasters of reduction works not equipped with sulphuric-acid plants, as much as 17,000 times).

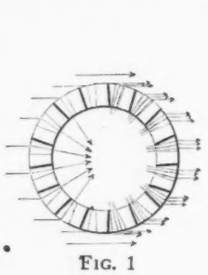


FIG. 1

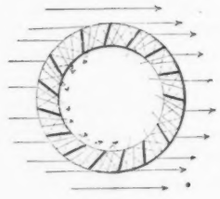


FIG. 2

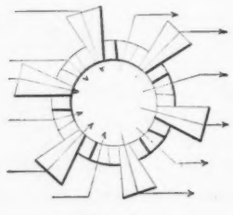


FIG. 3

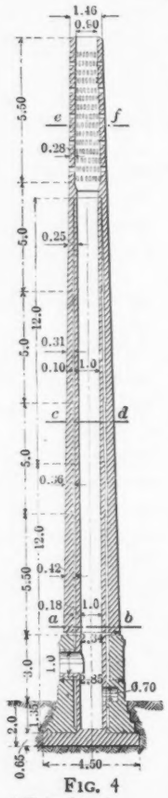


FIG. 4

The Engineering & Mining Journal

WISLICENUS CHIMNEY

ORDINARY DIFFUSION INADEQUATE

It is obvious that the atmosphere cannot render harmless such volumes of acid on the relatively short way from the source of the waste gas to the neighboring vegetation, considering that according to experience it cannot even take care of the coal-fire gases which are only 100 times too high in acid content. At a distance of several hundred meters where, with low chimneys, the visible chimney gases become transparent to the eye, vegetation may still be badly affected. Even in freely moving air the gases are only slowly diluted[1].

With some additions, the formula for the mixing or dissolving process, barring the effects of buoyancy, diffusion and wind action, is as follows:

$$t \text{ or } s \propto \frac{r\left(\frac{ma}{me}\right)^2}{(w-v)\,\alpha\,.\,T},$$

wherein t, the time (or s, the distance proportional to it) required for the ratio of dilution $\frac{ma}{me}$ of the waste gases me with atmospheric air ma is about proportional to the diameter $2r$ of the chimney, in the clear, the square of the required ratio of dilution, and inversely proportional to the difference between the velocity of the wind w and the velocity of escape v, and also inversely proportional to the dispersing angle α of the smoke jet and the temperature T of the waste gases.

HIGH STACKS GIVE ONLY LOCAL PROTECTION

This function goes to show that the mixing progresses slowly in the uniform currents of the higher air strata. In the lower strata the formation of eddies through natural obstructions (rises of the land, trees, buildings, etc.) is of the greatest influence on the rapid dissolution of the smoke. This explains the observation that lone and lofty industrial chimneys have a wider injurious range, even if they emit less acid gases in quantity (but stronger in concentration) than the hosts of chimneys of an industrial town, and even if they protect the nearest vicinity. About such large industrial towns only slowly lingering chronic damages to forests in the direction of prevailing air currents may be observed. It also follows that the air is only able under particular conditions to accomplish the one-hundred fold dilution necessary to render smoke harmless to an unfavorably situated plot of sensitive vegetation.

Gases which are not hot mingle slowly with cold air, especially from the moment when the direction and velocity of the air particles and of the waste-gas particles become equal or when the temperatures are nearly equalized. This is accomplished in a few seconds, at any rate long before the required hundredfold dilution can be attained.

[1]On this point the researches of J. Isaachsen, published in the *Verhandlungen des Vereines zur Beförderung des Gewerbfleisses*, 1902, part V, give valuable information.

Present Methods of Treating Acid Gases

Up to the present time it has been the custom to cope with this waste-gas nuisance technically on the following main lines:

(1) By extracting the acid; (a) through chemical absorption of the acid constituents by means of cheap basic substances (carbonates, metallic oxides, metallic scraps), chiefly with lime (limestone, quick lime or milk of lime), but also with carbonate of soda or oxides and scrap metal from the ore reduction. These methods are prohibitive when operating on a large scale on account of their cost; (b) through physical absorption by washing with water in scrubbers or spraying towers and filtering through filling material like coke, wood shavings, glass balls, etc. Washing yields good results only when applied in a judicious manner and when a profusion of water is available.

(2) By dilution; (a) by directly blowing air into the waste-gas flue or chimney. This method is not simple to carry out, and, for a considerable dilution, involves heavy expenditure for fans and other machinery; (b) by forcing the waste gases into higher air strata through mammoth chimneys, which is of doubtful value according to the above explanation of the mixing of smoke and air.

The result of the technical methods for freeing the waste gases from acid is imperfect without exception. There are always residual gases left which, in the most favorable case, approach the content of the waste gases from bituminous-coal fires (0.05 per cent. by volume), but in most cases cannot be reduced to less than 0.1 to 0.3 per cent. by volume, that is, 300 to 600 times too high. The deacidifying devices can only fill their natural purpose: viz., convert highly acidiferous waste gases into residual waste gases of comparatively low acid content.

Early Introduction of Air Needed

From this follows the necessity of looking for a simple means of promoting dilution of the waste gases, if possible without increase of operating expenses, that is to say, to create automatic dilution by the wind in motion. The lecturer has conceived such a device and tested its usefulness, at first on models and later in practice. The guiding principle is the judicious introduction of air currents previous to and during the escape of the gas from the chimney. At the same time anything that favors the formation of dissolving eddies must be taken advantage of.

Fig. 1 shows the division of the top of a chimney into properly distributed funnel-like vents or apertures, which increase in number or in width toward the mouth. Simple holes or slots in iron smokestacks are less effective, but come under the same principle if arranged in a sufficient number to effect a considerable dilution of the kind described. These vents allow the air on the windward side to enter the mass of waste gases gradually in all possible directions and with varying velocity. In that manner dissolving eddies and a gradual dilution are produced, while on the lee side the parted and diluted masses of waste gas emerge in small fractions through each series of apertures. The well known formation of rarefied air behind the chimney shaft when a strong wind is blowing, drawing down the smoke, is beneficial to the draft in the lattice shaft, because it produces a suction. The division and lively eddying offer to the current of wind the most favorable possibility of attack. Within a few seconds a considerable multiple of air is admitted to the waste-gas current during its escape without incurring any expense for machinery or other technical appliances which could furnish air only in fractions of the volume of the waste gases at great expenditure of power.

Fig. 2 shows the arrangement of a tangential disperser or dissipator, as the constructor calls it, that produces a spiral motion of the gases, but is only applicable to concrete or sheet-iron smokestacks.

Fig. 3 indicates the enlargement of distribution by partially lengthened-out vents in sheet-iron smokestacks. Two or more lattice shafts, arranged around one another, illustrate the principle of the multi-disperser. Such doubled lattice dividers are especially adapted to the mouths of flue-dust chambers in reduction works, to blast furnaces, etc., particularly on account of the comparatively small hight and the incomplete deacidification of such gases.

Fig. 4 shows a simple dispersing smokestack of recent construction.

Not a Smoke Consumer, but a Gas Diluter

The object of these lattice smokestacks, smoke dividers or waste-gas dispersers must not be mistaken. It does not consist in rendering the thick smoke invisible, although it promotes this operation, but the main object is to render the invisible part, the acid gases, innocuous to vegetation.

Each dilution which takes place inside or in close proximity to the waste-gas source aids the blowing wind in the dissolution in an increasing ratio. If, for example, only a three-fold dilution had been effected within the waste-gas source, the first dissolution of the formerly dense smoke will now be accomplished in one-ninth the distance.

The full efficiency of these dispersers can only be reached through correct construction, which is guaranteed by the Metallurgische Gesellschaft of Frankfort-on-Main, which has secured the patentee's license to build them.

The Island Process for Precious Metal Extraction

A process recently patented by J. S. Island, of Toronto, Can., for the treatment of the ores of the precious metals (Brit. pat. 13,488 of 1910) contains some features which are novel. In general the process consists in the introduction of steam or finely divided water vapor and sulphuryl chloride into finely pulverized ore. The water and sulphuryl chloride react, forming hydrochloric acid and sulphuric acid in contact with the finely pulverized particles of ore, this locally formed acid being said to be especially efficient in the solution of precious metals.

The process specifically mentions the use of a tube mill in grinding the ore, though other means of pulverizing are said to be included. The ore having passed from the tube mill having been reduced to at least 100 mesh, or finer, enters a mixer which is somewhat on the order of the old rotating Brückner roaster. Here it is heated somewhat, although the heating is in no sense a calcination but is simply to bring about a slightly elevated temperature in order to promote chemical action. Sulphur dioxide and chlorine are generated and brought into a vessel containing camphor, where they unite to form sulphuryl chloride, but here again any other catalyzer which will bring about this reaction can be used in the process. The sulphuryl chloride and steam are then introduced by separate pipes into the slightly heated ores. These acids created within the crushed ore and percolating through it are said to convert any precious metals into soluble salts. These are then leached and the metal precipitated in any of the customary ways.

Growth of the Aluminum Industry

The growth of the aluminum industry is one of the most striking features of modern metallurgical progress. Although aluminum is one of the most abundant metals in the earth's crust, as late as 25 years ago the production was only 300 lb. per annum, according to the U. S. Geological Survey. The increase in production is shown in the accompanying table.

ALUMINUM PRODUCTION IN THE UNITED STATES

Year	Lb.
1883	83
1885	283
1890	61,281
1895	920,000
1900	7,150,000
1905	11,347,000
1910	47,734,000

Militating against the still wider use of aluminum is the fact that bauxite is at present the only mineral from which it may be produced commercially. The great hope for its future lies in a process for its extraction from any clay.

Auriferous Gravels of Cariboo, B. C.

By E. Jacobs *

Profitable quantities of placer gold are assured by numerous investigations. Great difficulty has been to secure an adequate water supply.

*Victoria, British Columbia.

Cariboo district of British Columbia has a history dating back about half a century. The discovery and development of its riches were the most prominent features in the progress of the province in the late '50's and on through the '60's. In December, 1857, and again in January, 1858, Governor Douglas advised the Colonial Office, in England, of the discovery of gold within the Coteau, embraced by the districts of the Fraser and Thompson rivers. He wrote: "From the successful result of experiments made in washing the gold from the sands of the tributary streams of Fraser river, there is reason to suppose that the gold region is extensive, and I entertain sanguine hopes that future researches will develop stores of wealth perhaps equal to the goldfields of California—the geological formations observed in the Sierra Nevada of California being similar in character to the structure of the corresponding range of mountains in this latitude."

Bancroft, in his "History of British Columbia," says: "The first load of 450 adventurers left San Francisco on April 20, 1858. Between April 20 and June 9, 2500 miners, mostly from the interior of California, had taken passage by steamer from San Francisco; and it was estimated that 5000 more at the same time collected in Puget sound, on their way to the Fraser." Later, Bancroft refers to the "20,000 who went to the Fraser from California in 1858." Again, he says: "Late in the season of 1859 definite reports came that the search for gold had proved successful on the Quesnel; and in 1860, by the time the pioneers of the column reached Antler creek, 600 white miners were said to be engaged on this river, making from $10 to $25 a day, and occasionally turning up nuggets weighing from six to eight ounces."

Lack of space prevents much further reference to the early development of the Cariboo goldfield, but in passing it may be mentioned that the yield of gold in British Columbia during the 10 years, 1860-1869, is on official record as having aggregated $28,983,106, practically all from Cariboo and Fraser districts, the maximum yearly total having been $3,913,563 in 1863. The aggregate production of the Cariboo district to the end of 1910 is officially estimated at more than $40,000,000. After continuous production during a period of 52 years, the district is still yielding gold, although last year's yield was valued at less than a quarter of a million dollars.

Cariboo district is divided into the Cariboo and Quesnel mining division. The geology of the district has been thoroughly described by Amos Bowman, whose report is included in the Annual Report of the Geological Survey of Canada for 1887-8. In 1902 Wm. Fleet Robertson, provincial mineralogist for British Columbia, paid an official visit to the district; his report was printed in the Annual Report of the Minister of Mines of British Columbia for 1902.

The information that follows includes (1) an excerpt from Mr. Robertson's report, giving information relative to the gravel deposits of Quesnel division; (2) a brief extract from a report by Dr. Geo. M. Dawson, formerly director of the Geological Survey of Canada, showing the geological conditions noted in the pits of the Consolidated Cariboo Company's property; (3) a summary of the mining operations of the Consolidated Cariboo Company prior to suspension on account of cutting off of water supply; (4) notes relative to the occurrence of platinum and associated minerals with the placer gold; and (5) an account of the undertaking of the Quesnelle Hydraulic Gold Mining Company, now engaged in preparing to hydraulic gold-bearing gravels in the Quesnel mining division.

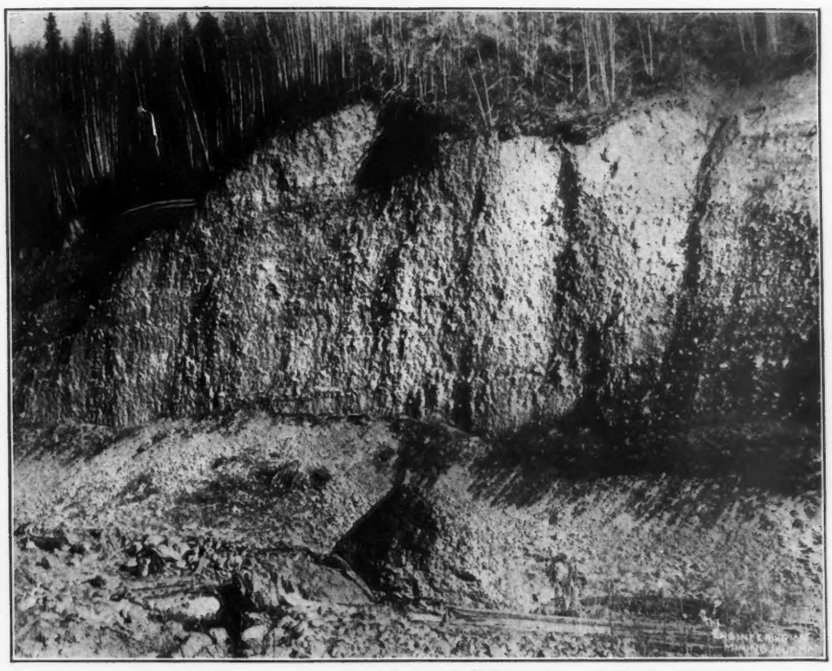
Great Deposits of Gravel

Mr. Robertson wrote: "The great, low-grade deposits have received their chief development about Quesnel Forks, and mainly at Bullion, where the Consolidated Cariboo Hydraulic Company (John B. Hobson's syndicate) has done so much work. The channel here worked by Mr. Hobson is only one of many in the immediate vicinity, some larger and quite as rich. Naturally, Mr. Hobson acquired what seems the most available deposit, but he pointed out to the writer several deposits which he has investigated since, and which he claims offer chances for larger companies than that he is now operating. The Consolidated Cariboo may be taken as an example of what to expect, namely, gold value of about 10c. per cu.yd. Mr. Hobson claims for his company that he has leases of 500,000,000 cu.yd. of auriferous gravels, and it is safe to say that he has not in these leases one fifth of the available gravels, so that in this section

Town of Hydraulic, B. C.

Quesnelle Company's Spillway, Etc.

alone there must be from 2,500,000,000 to 3,000,000,000 cu.yd. of auriferous gravels, which there is every reason to think will be as rich as the Consolidated Cariboo Company's deposit. The immensity of these figures is hard to grasp, but to illustrate—if 10 cu.yd. yield $1 in gold, then there is in the Quesnel section alone $300,000,000 worth of gold. This vast amount of gold is so diluted with sand and gravel that the only possible means of extracting it is by the use of immense volumes of water under pressure; in other words, by hydraulic mining. Mr. Hobson collects the rainfall of the season over 60 sq.mi. of territory, which he utilizes through one monitor, with ground sluices, in from 66 to 150 days. Even then he has only sufficient water to work in one place, using from



GRAVEL BANK, CARIBOO DISTRICT, B. C.

300,000 to 600,000 miners' inches each season, or more than 1,200,000,000 cu.ft. of water. So it will be seen that the water is the great question. There is gold and to spare, but the auriferous gravel deposit, without water to wash it, is of no value. As far as water supply goes, Mr. Hobson has undoubtedly secured that which was most available, that is, which could be utilized with the least expenditure of capital, and from his costs an idea can be formed as to what expenditure of capital would be necessary to bring water on to other properties. The sum required would probably be much greater than it was in this first instance. From this it is argued that the immense gold reserves of this section can only be touched by companies of the strongest sort, willing and able to invest large amounts of capital to bring on water in large quantities. While this is true of most of the great gold deposits of this section, there are a number of spots where a local concentration of value has occurred, and which are being, or can be, profitably worked in a small way.

"While particular attention has thus been drawn to the Quesnel Forks section, this has been done only for the reason that in this vicinity there are the most extensive development and the most authentic data upon which to base estimates. Similar auriferous deposits occur to the south at Harper's, to the west at Quesnel Mouth and Cottonwood, and with the northern limit undefined and unexplored.

"A gravel deposit is only available for hydraulicking when it has: (1) A sufficiency of gold, in a free state, to pay; how much this will have to be will vary with the conditions. (2) A sufficiency of gravel to admit of a large enough amount being earned to pay for installation of necessary plant. (3) A sufficiency of water under pressure to disintegrate and wash into sluices the gravels, etc. (4) A sufficient grade from the lowest part of bedrock to carry off and dispose of tailings. Practice puts this grade at from 4 to 5 per cent., and it may be natural or obtained by artificial cuts or tunnels.

"There are other conditions which are desirable, but those enumerated are essential. In this district there is no difficulty in satisfying the first two of these conditions. The third can usually be satisfied, but not always at a permissible cost. For the great mass of the deposits the fourth seems to be the hardest condition to satisfy. In this district the bedrock, in the length of the channel, does not carry sufficient grade for sluicing, so that any channel which can only be attacked from the end must soon run to deep rock cuts, if even such are possible. So that while of these great auriferous deposits a large number are not so situated as to comply with all of the required conditions, and a number of claims have been staked in the district in utter disregard of these essentials, still, for all that, the amount of auriferous gravels which does now exist here, and which can comply with all these requirements, is so great as to leave the quantity of available gravel beyond all question, and the whole future of the district turns on the cost of getting water in sufficient quantity."

GEOLOGICAL CONDITIONS AT BULLION

As regards the geological conditions of the Consolidated Cariboo company's property, the following is taken from a report of the late Dr. George M. Dawson, of the Geological Survey of Canada: "The geological conditions, as displayed in the two pits above described, are of great interest, but in the present summary it is possible only to allude briefly to the main facts. In the old 'South Fork pit' the section, in descending order, shows: (1) Ordinary boulder clay with many glacially striated stones, 60 ft., containing little or no gold. (2) Stratified sands and gravels, 120 to 130 ft., yielding gold to the amount of about 5c. per cu.yd. (3) Hard 'lower boulder clay,' with few glacially striated stones, 30 ft., not known to contain any gold. (4) Well rounded gravels, to bedrock, 30 ft., rich in gold.

"In the 'China pit' the section exposed is as follows: (1) Stratified gravels, seen along a portion of the top of the face only; greatest thickness, about 30 ft. These contain gold to the amount of about 5c. per cu.yd. (2) Boulder clay, about 100 ft. thick, in what appears to present the axis of the old channel, but running out to nothing on each side; not known to hold any gold. (3) Rather hard, roughly stratified gravels and sands, with clayey matter; the stones well rounded and often large. Maximum thickness, about 310 ft. to bedrock; minimum thickness (where the overlying boulder clay is deepest), about 200 ft.; rich in gold.

"The gold content of the several deposits, as above stated, results from tests made by Mr. Hobson and communicated by him to me. The equivalency of the strata in the two pits is not quite certainly determined, but No. 1 in the 'China pit' is believed to represent No. 2 in the 'South Fork pit,' No. 2 to represent No. 3, and No. 3 to represent No. 4, respectively. The bedrock appears to be generally a much altered and shattered greenstone (diabase?) penetrated by syenitic dikes, and including a considerable body of syenite near the 'China pit.' In regard to age, it would appear that the lower and

richer deposit in each pit is preglacial, while the upper gravels in the 'South Fork pit' (No. 2) are certainly, and those in the 'China pit' (No. 1) probably, of interglacial origin."

A summary of the mining operations of the Consolidated Cariboo Hydraulic Mining Company during nine years, 1897-1905, both inclusive, is contained in the table printed herewith.

OPERATIONS OF THE CONSOLIDATED CARIBOO HYDRAULIC MINING COMPANY

Year	Time Run, Days	Water Used, Miners' Inches	Gravel Moved, Cu.Yd.	Gold Recovered, Value	Average Yield, per Cu.Yd.
1897	112	223,416	840,130	$138,520	16.49 cents
1898	129	264,881	821,870	105,141	12.78 cents
1899	144	353,056	1,952,535	92,679	4.07 cents
1900	172	460,878	1,843,938	350,086	18.98 cents
1901	104	258,250	2,420,288	142,274	5.8 cents
1902	66	179,520	690,442	61,395	8.89 cents
1903	53	127,083	373,000	44,944	12.05 cents
1904	89	225,198	1,461,341	85,936	5.88 cents
1905	15	45,052	183,984	21,733	11.81 cents
	....	.....	10,587,528	$1,042,708	9.85 cents

Platinum and Associated Minerals

In his annual report for 1904 to the Consolidated Cariboo Company, Mr. Hobson gave the following information as to platinum, palladium and osmiridium, occurring with the gold:

"For several years past, qualitative tests have been made from time to time for the presence of gold, platinum and osmiridium, in the heavy concentrates that remain in the sluices after cleaning up; while making one of these tests in May, 1903, the presence of palladium was indicated, in addition to platinum and osmiridium. An analysis of a sample of concentrates, made by J. O'Sullivan, of Vancouver, B. C., in May, 1903, gave large percentages of gold, platinum, palladium and osmiridium, which brought the value of the concentrates up to $3872.76 per ton. A second sample, from a pan of concentrates taken from the sluices after the cleanup in September, 1904, was sent to Mr. O'Sullivan, with the following results in ounces per short ton: Gold, 95; silver, 180; platinum, 64; palladium, 64.4; osmiridium, 42 oz.; copper, 10.5 per cent.

"The gold and silver are, no doubt, included in particles of pyrite and argentiferous galena and partly in small particles of gold covered by manganese and other metallic oxides, and cannot be recovered by the process of amalgamation. The platinum, palladium and osmiridium are found in minute metallic grains and also inclosed in small fragments and nuggets of magnetite and chromite, which appear to make up quite a large percentage of the sluice concentrates after cleaning up. What quantity of these high-grade concentrates is included in the deposits, or can be recovered therefrom, cannot be determined until after completion of a system of undercurrents to be placed at the end of the sluice."

Quesnelle Hydraulic Gold Mining Company's Line, Cariboo, B. C.

Quesnelle Company's Dam, Ditch and Flume, Cariboo District, B. C.

Quesnelle Hydraulic Gold Mining Company's Enterprise

The Quesnelle Hydraulic Gold Mining Company, which is financed by Philadelphia and New York capitalists, has in hand one of the most important hydraulic gold-mining enterprises yet undertaken with the object of working the auriferous gravels occurring in the Cariboo district. It owes its conception primarily to Howard W. DuBois, of Philadelphia, who, while investigating the occurrence of platinum in the Quesnel mining division, "discovered" a source of water supply that seemingly had been overlooked by others, and ascertained that it would be practicable to bring the water down to deposits of gravel; these have since been acquired under lease from the Provincial Government by the company, which is now energetically engaged in preparing to recover gold from them.

Mr. DuBois found that the quantity of water flowing in the upper part of Swift river, where it had escaped the notice of others interested in hydraulic mining in the district, is much larger than lower down in the vicinity of ground suitable for hydraulic placer mining. When the water reaches the gravel country most of it sinks into the gravel; consequently the stream becomes comparatively insignificant. It was found, on the other hand, that before the water reaches the gravel the stream has a flow varying from 10,000 to 30,000 miners' inches, with an average through the season of fully 15,000 inches. Gaging with a current meter during three seasons indicated that the minimum flow of water is considerably in excess of the quantity required to be diverted for hydraulic-min-

ing purposes. Upon taking levels it was found that physical conditions were favorable to the utilization of this water at a cost which, although large, was not considered prohibitive.

The requisite financial arrangements having first been made, about three years were occupied in prospecting the gravels about Twenty-mile creek and surveying the country between Quesnel and Swift rivers. Eventually the larger enterprise was launched and the work now approaching completion was undertaken. Many preliminary difficulties had to be overcome, and prominent among these were: (1) The long distance from a railway (more than 200 miles by wagon road), and (2) the entire lack of wagon roads in that part of the district. The magnitude of this latter obstacle to speedy progress will be made evident when it is stated that about 40 miles of wagon road has been constructed by the company, at a cost of nearly $60,000, in order to make its property accessible from the Government roads established in other parts of the district.

Mr. DuBois, who is the company's general manager and engineer, maintains that the enterprise possesses the four chief features essential to profitable hydraulic mining, namely (1) an abundance of water under adequate head, (2) extensive dumping facilities, (3) ample grade for sluicing, and (4) gold in the gravel in payable quantity. With only a moderate supply of water, John B. Hobson has demonstrated what can be done in hydraulicking the low-grade gravels of this district, so there is little room for doubt that with the abundant supply of water possessed by the Quesnelle company success is assured. By the time this company's water system shall have been completed, nearly $1,000,000 will have been expended on the whole undertaking.

Physical Features of the Country

Between the upper part of Swift river and Quesnel river is elevated country, forming a divide, previously taken for granted as an obstacle to the bringing of water from Swift river to the Quesnel slope. Swift river flows northwest into Cottonwood river, and the latter stream, continuing in the same general direction, enters the Fraser some distance above Quesnel, at the junction of Quesnel river with the Fraser. Quesnel Forks is approximately 50 miles southeast of Quesnel, at the confluence of the north and south branches of Quesnel river. The placer gold mines of the old Consolidated Cariboo company (of which Mr. Hobson was for years general manager), subsequently acquired by the Guggenheims, are at Bullion, in the vicinity of Quesnel Forks, and the sources of their main water supply are east and southeast of the Forks, within a radius of about 15 miles. Twenty-mile creek, along which are situated the gravel deposits of the Quesnelle company, joins Quesnel river about 25 miles below Bullion, the center of the Consolidated Cariboo operations.

The company's hydraulic leases cover approximately 800 acres of gravel beds, situated around the lower part of Twenty-mile creek, at its junction with Quesnel river and thence down the river. In places the gravel banks are 500 ft. high; a photograph of one place, where about 200 ft. of gravel is exposed, is reproduced herewith. It is estimated that along a well defined old river channel is a body of auriferous gravel approximating 100,000,000 cu.yd. in quantity; detailed testing of the gravel was restricted to only a part of the property, estimated at 30,000,000 cu.yd. in volume. This part was found to contain gold enough to justify the expense of the works and equipment for operating by the hydraulic process.

200-ft. Gravel Bank

Water Supply

The flow of water was considered to be so much in excess of actual requirements for the purposes of hydraulic mining that it was not thought necessary to make provision for storing water, so the dam, which is 600 ft. long and 35 ft. high, was constructed only for the purpose of diverting it. An accompanying view shows the dam, waste weir and intake at Swift river.

The catchment area above the point of diversion is more than 200 sq.mi. in extent; it is well wooded, and the snow does not disappear until late in the season, its gradual melting thus maintaining an abundant supply of water during even the driest years. In its application to the Government for the right to use the water, the company petitioned for permission to divert 250 cu.ft. of water per second.

The ditch line is approximately 19 miles in length; it is being constructed across public lands, and the difference in altitude between the point of diversion and that at which the water will be returned is about 1000 ft. From Swift river to Pass lake, at the head of Twenty-mile creek, the distance is 17½ miles. Construction of about 13 miles of the water system had been completed by the beginning of last winter, and water has been run through this length. During the winter months much material was prepared, ready for a resumption of construction work in the spring, when the weather would be suitable.

Conditions for both construction and maintenace of the ditch are generally most favorable. First, the country through which it passes is nearly level, except at several places where inverted siphons had to be provided and in one part where a tunnel had to be driven 550 ft. in hardpan and clay; next, the ground is for the most part compact, at least half the ditch being in hardpan which, while costing more to excavate, insures an important saving in maintenance, beside rendering the loss of water from seepage unusually small.

In all, about 10,000 ft. of wood-stave pipe, 60-in. diameter, has been used. This pipe has been constructed from spruce wood cut in the neighborhood and made into staves on the spot. The staves are bound together by ½-in. steel bands, suitably spaced according to the pressure to be provided against. About 200 tons of steel has been used in the bands on the siphons. The longest siphon is 5635 ft., this being required to pass over a depression having a maximum depth of 110 ft. Another length of pipe is 2290 ft., crossing uneven ground the lowest part of which is about 80 ft. below the grade line. A third siphon is 1050 ft. long, and its maximum depth below standard grade is 30 ft. There is but little flume work between Swift river and Pass lake, though there is more than one-third mile of it beyond the lake, as stated below.

Twenty-mile creek channel is to be used from Pass lake 3½ miles to a flume intake, the water line being continued thence by, first, a flume 5 ft. wide by 4 ft. high and 2000 ft. in length; then a ditch for about 4000 ft.; and finally from the penstock by 6500 ft. of steel pipe to the gravel pits. This pipe will be of 30-in. diameter where it leaves the penstock, and of graduated sizes down to 16 in. at the mine, where, under a 300-ft. effective head, two No. 6 monitors, of the Hendy-Bouery type, will be used. The water system is designed to deliver 3500 miners' inches of water *per diem*, and it is calculated that from 12,000 to 15,000 cu.yd. of gravel will be moved daily.

Arrangement of the Workings

Below the pits will be a double sluiceway, about 600 ft. in length, on a 5 per cent. grade, each sluice being 6x4 ft.

Having two sluices will permit operations to be carried on without the delays usually occurring where there is only a single sluice. The upper parts of the sluices will be paved with cottonwood blocks, which in Cariboo district have been found very serviceable, and the lower parts with stone. It is intended next season to put in high-carbon steel plates, which wear well and increase the capacity of the sluices. In Atlin district, also in British Columbia, sluices lined with steel have been found effective. The short length of the sluices is a favorable feature; they are much shorter than some that have been used in the district, which will be a factor in diminishing upkeep charges. Conditions as regards dump are stated to be unusually advantageous, for Quesnel river, into which the tailing will be discharged, is a strong-flowing stream, so that it is expected it will carry away the débris rapidly.

The length of the season for hydraulicking will, it is thought, be at least two hundred 24-hour days, the open season in this part of Cariboo district being much longer than in the northern portion, and the ditch has been constructed along a route that will allow the water to run both earlier and later in the season than is usual in most parts of this region. Construction work at the lower end will not be completed, however, until the middle of the present summer, so that gravel washing will not last longer than 100 days of the 1911 season. When in full working order, about 30 men, including those attending to the water-supply system, will suffice to carry on mining operations under ordinary conditions.

The company's headquarters in British Columbia are at Hydraulic, a new town situated near the junction of Twenty-mile creek with Quesnel river. This is reached from 150-Mile House, on the main road from Ashcroft to Cariboo; also by a newly constructed road that branches off from the main road at a point about 13 miles south of Quesnel. Ashcroft is 203 miles distant from the city of Vancouver, on the main transcontinental line of the Canadian Pacific railway.

When the Grand Trunk Pacific railway, now in course of construction, shall be completed, the nearest railway station north will be less than half the distance north from Hydraulic that Ashcroft is south. At the new settlement are telegraph station and post office, both named Hydraulic; the Government telegraph system established in Cariboo affords telegraphic communication with the outside. The company has its own telephone connections with all parts of its property. The aggregate length of telegraph and telephone lines is about 40 miles. It has been decided to equip the property throughout with facilities for lighting with acetylene, which is considered both cheaper and more effective than electric light for local requirements.

The photograps used for illustrating this article were kindly supplied by Howard V. Du Bois.

Metal Resources of Philippines*

By Warren D. Smith†

During the three centuries of Spanish occupation, little mining was carried on in the Philippine islands. The year 1905 practically marked the beginning of production in the island under the American regime. Gold is found in some quantity in nearly every part of the Archipelago, and although it is not the most important mineral asset, it holds the first place, for it is the easiest to mine and does not depend upon a market.

Three Principal Gold Districts

The three principal gold-mining districts are, Ambos, Camarines, Benguet and Masbate. In the first-named district, near Paracale, mining is largely confined to dredging, although development on the lodes is in progress. The country rocks are largely schistose, diorite, gneissic granite and slaty shale. The veins, so far as known, are of only moderate width, but rich. Lode mining is farther advanced near Mambulao, there being 20 stamps dropping on the San Mauricio property and a Huntington mill operating on the Tumbaga. On the Paracale river there are two New Zealand dredges, while an American (Risdon) dredge is digging in the Malaguit. A large Bucyrus dredge will shortly be installed on the Gumaus river.

The dominant rocks in Benguet are diorite and andesite and the gold is found in fairly large quartz and calcite veins in north-south, east-west and northwest-southwest systems, cutting the formation indiscriminately; that is, they are fissure veins. Gold occurs both native and as telluride. The ore is not entirely free-milling and cyaniding is resorted to. The chief characteristics of this ore, except in one or two cases, are the general absence of manganese and the abrupt change from an all-quartz gangue to all-calcite within short distances. Altogether there are only nine stamps dropping, two mills having been badly crippled in the fall of 1909. However, two new mills are about to begin operation.

Country Rock is Andesite

In the mining district of Masbate the country rock is largely andesite in old worn-down volcanic stocks. The andesite is cut by a system of northwest-southeast quartz veins, one of which is over 20 m. wide. The ore is oxidized to a much greater extent than is the case in Benguet, but is only partially free-milling. This ore also contains large amounts of manganese oxide. There are four principal companies in this district, but not one in the producing state. Some dredging was attempted in this district, but for various reasons was unsuccessful.

Some silver is found in all the gold districts, usually alloyed with gold. Native silver has been encountered in Benguet in small quantities. Practically all the lead is argentiferous. Copper was found in the form of arsenates and sulphides in the Mancayan-Suyoc district of the Mountain province, Luzon, as native copper in Masbate, the Camarines and the Island of Jolo. The best known deposit is that in the Mancayan-Suyoc district. According to Eveland, it seems that the general type of vein in this district is the narrow quartz lead, carrying metallic sulphides in some cases of copper, and generally with gold associated in a free state. These veins are in the Mancayan diorite, which underlies the entire district. With the advent of the trachyte flow, metamorphic changes have taken place and the nature of the country rock is altered to a considerable degree. Recent development work has shown, however, that this deposit is more in the nature of a stockwork and it appears to be more extensive than was thought to be the case.

Base Metals

Lead and zinc are associated in some of the Camarines deposits. Argentiferous lead occurs in many places, principally in Cebu and the Island of Marinduque. In Cebu it is of the nature of a stockwork in an andesite flow. Iron ore in the form of hematite, magnetite and limonite with varying percentages of iron have been found in several places. There is a fairly well defined belt which follows the east coast of Luzon for a short distance, beginning in the Camarines and then swinging into the interior, where it reaches its greatest development, so far as known, near the town of Angat, in Bulacan province. Three small blast furnaces of crude design are now operated.

Manganese oxide occurs in Ilocos Norte in nodules concentrated in shallow beds. The original situation of this substance was traced by W. D. Smith to small stringers in a recent andesite flow. Manganese occurs in small pockets in the quartz veins in the gold districts of Benguet, Masbate and Camarines. Coal is found on nearly every island of the Archipelago. The coal measures belong to the Tertiary period and are sub-bituminous. The production in 1909 was 31,000 metric tons. There is only one producing mine at present, the East Batan Coal Company on the little island of Batan.

*Abstract of an article in *Philippine Journ. of Sci.*, November, 1910.

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The Blum Zinc Oxide Process

According to a recent patent the Huntington-Heberlein pot is adapted to the manufacture of zinc oxide. Advantages claimed are larger charges, less contamination of the oxide with iron, and production of easily discharged porous clinker.

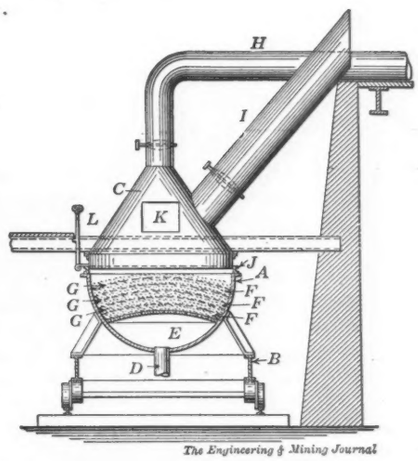
A process for calcining zinc ore for the production of white oxide has been patented by Abraham Blum, of Monterey, Nuevo Leon, Mexico (U. S. pat. 993,019, May 23, 1911). The following extracts from Mr. Blum's description outline the disadvantages of the present practice and the method designed by him to overcome them.

The characteristic feature of the invention consists in making up the charge of layers of fuel, alternating with layers of mixed fuel and zinc ore. The layers of fuel constitute auxiliary heating zones. The layers of mixed fuel and ore constitute zones wherein the zinc ore is subjected by direct contact to the reducing action of the fuel forming a part of the mixture. The resultant effect is that the desired conditions for effectively reducing the ore and for oxidizing the zinc vapors produced to white oxide are fully realized, while at the same time the total amount of zinc ore capable of being treated in a single charge is correspondingly multiplied.

The Customary Practice

In the Wetherill process for the production of white zinc oxide, ore mixed with coal is thrown upon a bed of burning coal spread out upon a special perforated grate, through which air is blown. The products of combustion, together with the zinc oxide, are drawn off from the furnace and the zinc oxide is filtered out in the bag room provided for the purpose. The capacity of the Wetherill furnace varies from about 120 to 150 kg., and the furnaces are generally assembled in double groups of six. It takes from six to eight hours to burn a single charge; the furnace burns three charges a day, and requires the same weight of coal and ore and needs three men per group. The Wetherill furnace is of the reverberatory type and is operated with a blast of from 1 to 2 oz. pressure. The low pressure of the blast prohibits the use of more than one layer of charge above the burning coal, because the slag incident to the operation so far reduces the pressure of the blast that the reduction of zinc ore in a second layer would not be possible. In the Wetherill process, therefore, as above noted, only a single layer of the zinc-ore charge is treated, and it is necessary to clean the furnace grate at the termination of the operation and before the furnace is recharged. Consequently, the Wetherill furnace, although realizing a good recovery, is correspondingly expensive, because of the relatively small amount of ore which a single furnace can treat per day.

Experiments have also been made for the treatment of the residues of zinc smelteries, by mixing them with 40 per cent. of coal and blowing the mixture, under high pressure, in a converter of the Huntington-Heberlein type. These experiments, however, have not resulted in a commercial process. The depth of the charge employed necessitates the employment of a blast of high pressure in order that the zinc may be extracted before the slag is formed. Furthermore, it is necessary to heat up the charge very quickly, otherwise the zinc oxide produced, coming in contact with the cold upper part of the charge, will remain therein in a crystallized condition, and will not be volatilized again, so that the recovery is correspondingly poor.



Blum Zinc-oxide Furnace

Moreover, the employment of a blast of high pressure produces furnace conditions which result in the reduction of the iron oxide contained in the ore. The iron is thereupon reoxidized and passes with the zinc oxide into the filter bags, making the zinc oxide yellow, and the zinc oxide itself is found to carry not more than 60 per cent. of zinc, in contradistinction to the much higher percentage of zinc carried by white oxide. Finally, because of the high temperature incident to the operation, it is difficult to treat a charge containing more than 400 kg. of ore.

In the practice of my invention, on the contrary, it is entirely feasible to treat charges containing from one to three tons of ore at a single operation, and in an ordinary conical pot or converter, having a perforated bottom. The alternate arrangement of the layers of coal, and of ore and coal mixed, permits the desired temperature conditions to be realized promptly throughout the charge, so that the reduction proceeds with corresponding uniformity. Crystallization of zinc oxide in the upper layers of the charge is avoided, and the pressure of the blast is restricted to such a range that the zinc oxide produced is not yellowed by the reduction of the iron constituent of the ore and the reoxidation of the iron; and, instead of the highly liquid slag incident to the employment of excessive temperatures, a fairly porous cinder is produced which may be readily discharged from the converting vessel and which, during its formation, does not interfere with the conduct of the operation.

Operation of New Process

In carrying out my invention, I may employ any suitable pot or converter, as, for instance, the well known Huntington-Heberlein converter. For instance, a converter actually used by me was of the conical type, 1 m. high and 1.20 m. in diameter at its upper edge. The opening for the entrance of the air blast was 20 cm. and was below the false bottom, which, slightly curved or arched, had a diameter of 80 cm. with a series of perforations extending through it of about 11 mm. in diameter. The pot or converter was capped with an iron hood and connected with the bag house through a pipe line 40 cm. in diameter and 30 m. long. The bag house was connected with the pipe line through a fan and was provided with a settling chamber and the necessary cotton-cloth filter bags.

In using a pot or converter of this general character, I have found it suitable and desirable to employ layers of a thickness of 10 cm. in making up the charge, these layers being alternately anthracite coal and a mixture of anthracite coal and zinc ore. For instance, for the treatment of a zinc ore made up of Minas Viejas, crude, low-grade fines, running 23 per cent. zinc and 23 per cent. iron, and free from lead and arsenic, I have employed a coal having volatile matter, 7 per cent.; fixed carbon, 86.8 per cent., and ash, 6.2 per cent. In this particular instance, when a four-layer charge was employed (i.e., a bottom layer of coal resting upon the perforated grate, a layer of mixed zinc ore and coal resting upon the bottom layer, a layer of coal resting upon the mixed ore and coal layer, and a top layer of mixed ore and coal), the entire charge contained 120 kg. of ore

and 120 kg. of coal. Of the coal, 48 kg. was used in making up the layers of mixed ore and coal, and may properly be designated as "reducing" coal. The remaining 72 kg. were used for the auxiliary heating layers, and may be designated as "heating" coal. The ore was crushed to 6 mm., the "reducing" coal to 12 mm., and the "heating" coal to 25 millimeters.

Each layer was of a thickness of 10 cm. The ignited charge was then blasted, beginning at a pressure of 2 in., gradually rising to 12 in. as the operation progressed, and being again lowered somewhat. A good reaction was started after 30 min., and the blast was continued for a period of six hours, the resulting product being a zinc oxide containing 76.5 per cent. of zinc.

Possible Modifications

While good results can be thus obtained from the employment of four layers as described, I nevertheless prefer and recommend the employment of an additional layer of coal and an additional layer of mixed ore and coal, making six alternate layers of the same preferred thickness of 10 cm. In such case it will usually be preferable to continue the blow up to, say, seven hours, because of the greater amount of material treated and because the reaction does not seem to start as promptly. In general, it will not be found advisable materially to exceed this proposed maximum, for the reason that to do so would increase the duration of treatment of the charge, and consequently there would be no saving in the capacity of the converter.

It will, of course, be understood that the example that I have above given from actual practice is but one illustration of the capacity and character of the invention. Even with the Minas Viejas low-grade crude fines, the process gave a product of good quality, although the crude ore contained as low as 23 per cent. of zinc and as high as 23 per cent. of iron, and although the converter employed was of a relatively moderate capacity.

For larger industrial uses I recommend a pot or converter, say, 75 cm. high and 2.10 m. inside diameter, which would be able to treat, under similar conditions of operation, three tons of ore in a single charge, or nine tons per day, an amount equal to the daily capacity of 20 Wetherill furnaces. So, also, two converters, each having a capacity for treating nine tons of ore, i.e., a total capacity of 18 tons, will require for their operation not more than five men, a saving of 50 per cent. of labor for equal capacity as compared with the Wetherill furnace, 12 Wetherill furnaces requiring the services of three men to 5.4 tons of ore per day.

Apparatus Employed

In the accompanying drawing, I have illustrated a suitable apparatus for the practice of my invention. The pot *A*, which may be supported in any convenient way, as, for instance, on the wheeled truck *B*, is provided with an air-blast pipe *D*, and a perforated bottom *E*. Upon the perforated bottom are arranged the layers of heating coal *F*, alternating with the layers of mixed ore and reducing coal *G*. *C* represents a collecting hood, having a pipe line *H* leading to the bag room, and a pipe *I* leading to the chimney, these pipes being severally provided with valves or dampers. The hood may further be provided with a suitable number of closable charging openings, as *K*. A ring or annulus *J*, adapted to be raised or lowered by the handle *L*, serves to establish a sufficient connection between the pot *A* and the hood *C*.

It will, of course, be understood that I do not restrict myself to the employment of layers of coal, or of mixed coal and ore, of but 10 cm. thickness. They may materially exceed that thickness, or they may be of lesser thickness; but, in general, it will not be advisable to increase the thickness of any of the layers to exceed 20 cm., nor to have any of them of materially less thickness than 10 cm. In all cases, having in view the composition of the particular grade of ore treated, provision must be made to obtain the thermal effects desired in the heating zones or layers, and the corresponding reducing effects in the layers of mixed coal and ore, by making appropriate distribution of the coal employed; that is to say, by using coal layers of thickness sufficient to meet the requirements of the layers of mixed ore and coal, and by using an amount of reducing coal in the mixed layers suitable to the kind of ore under treatment. If lead is a constituent of the ore, the product will be a white zinc-lead pigment.

Before the starting up of the reaction the products of combustion, which always contain some free hydrocarbon, should be discharged through the furnace stack, without going to the bag room; otherwise more or less yellowing of the zinc white oxide will result. But should the connection to the bag be made prematurely, any resultant yellowing of the product can be removed by subjecting it to heat in a muffle for a few minutes.

Maryland Mining Conditions

Statistics of the U. S. Geological Survey show that the coal mines of Maryland gave employment in 1910 to 5809 men, who worked the unusually high average of 270 days, and although 97 per cent. of Maryland's tonnage is hand mined the average productive efficiency of the miners is above the mean average for all the States. In 1910 the average production for each man employed was 898 tons for the year and 3.33 tons for each working day. No labor troubles were reported in 1910. The mines are operated 10 hours per day.

New Westinghouse Direct Current Motor

The Westinghouse Electric and Manufacturing Company has announced a new direct-current motor for general power service. One of the features of this new motor, type SK, is its excellent commutation, which is obtained partly by the use of commutating poles and partly by the careful design of the commutator, brushes and brush holders. Practical service tests have shown almost sparkless commutation under all conditions of speed or load up to extreme overloads. Another characteristic of importance is the large dust-proof bearings, and the efficiency of the oiling system. Large oil rings keep the bearing surfaces well lubricated whenever the motor is in operation, but the oil cannot leak or be thrown out of the oil well.

Westinghouse Direct-current Motor

As can be seen from the accompanying illustration, the motor is extremely simple in construction. The frame is of a new design. It is a ring of open-hearth steel made by hot-rolling the slab into shape and welding the ends together. Rolled steel is an ideal material for motor frames because of its high magnetic permeability, uniform structure, and great strength. The feet are pressed from steel plate and are riveted under great pressure, making a rigid construction.

The armature is so wound that wide spaces are left between the ends of the coils, and ventilating ducts are provided in the core, assuring ample ventilation. The coils are form wound, laid in open slots and held by fiber wedges and bands. The shaft can be pressed out without disturbing the armature windings and commutator connections. These motors are made for 115, 230 and 550 volts in capacities of from 1½ to 50 h.p. The speeds correspond closely to the full-load speeds of induction motors, making changes from motors of one class to those of another comparatively easy.

English Mining Legislation

By T. Good*

Up to 1842 working conditions in mines were shocking. Safety regulations and devices have improved these conditions. Recent laws are too inflexible, resulting in increased accidents and dissatisfaction to both owners and miners.

*Stannington, Sheffield, Eng.

In view of the growing movement in favor of the adoption of safety devices, and the enactment of special laws in the interest of the mine workers of the United States, a brief account of what has been done in England, both by legislative and voluntary effort to promote safety in coal mines, may be of some interest to American readers, while a record of the mistakes made in that country may serve as a warning to those people in the United States who seem to rely too much upon Government interference.

Early Miner's Lot a Hard One

Down to the middle of the last century the miner's lot was probably worse than that of any other manual worker in this country. Hard labor, long hours and low wages, primitive appliances, inadequate ventilation and bad drainage, dangers and hardships under revolting conditions were the chief features of the miner's life. Women and children, who worked in the pit along with the men, were harnessed like horses, and hauled coal from the workings to the shaft. The accident rate was appalling.

In these circumstances it is little wonder that when once the state made up its mind specially to protect the workers, the question of mining labor received more attention than any other. Mining now is rendered nearly as safe and healthy as human laws can make it, and the miner is raised to a position of high independence and privilege.

Although miners were specially mentioned in several acts of Parliament, between 1736 and 1831, it was not until 1842 that anything was done by the state to promote their welfare. All the measures relating to mining prior to that year were for the benefit of the mine owners. Indeed the commonest rights and liberties were withheld from miners for a generation after they were granted to other workmen. Severe penalties were inflicted upon miners for the most trivial offenses.

Better Conditions Since 1842

But after a succession of acts for the benefit of capital, an act was at last obtained for the benefit of labor. The famous measure of 1842 prohibited the employment of women and girls below ground; also the employment of boys under 10 years of age. It provided that mine inspectors be appointed, that winding engines should not be controlled by persons under 15, and that wages should not be paid in a public house. Later acts provided among other things for the fencing, lining and casing of shafts; for ventilation and drainage; that no boy under 12 be employed in a mine unless he could read and write, or was permitted to attend school on two half-days a week; that engines should not be controlled by persons under 18; and that the miners should appoint their own check-weighman.

In 1862 an act was passed for the provision of duplicate shafts. This was the outcome of a terrible shaft accident in which 202 lives were lost for want of another outlet. In the Act of 1887 the age of winding-engine men was brought up to 22 years; provision was made for better timbering, drainage and ventilation; for efficient lamps; for the proper use of explosives; for ambulance appliances; for uptodate signaling; and a multitude of other safeguards. In 1897 miners were included in the first Workmen's Compensation Act. In 1908 the famous Eight Hour Bill was passed.

Safety Measures Decrease Accidents

In the last 10 years the number of coal-mine workers killed annually was only one in every 762 employed, whereas in 10 years in the middle of the last century the number was one in every 249. Unfortunately our accident rate has now begun to rise, but comparing the 10-year period ending 1905 with that ending 1885, there is a remarkable record of progress. At the close of the nineteenth century, mines were three times as safe as they were in the middle of the century. In 50 years the accident death rate dropped 60 per cent. But the invention of safety devices and improved appliances and equipment has done more for industrial betterment and the promotion of safety than all the acts of Parliament.

Legislation has been beneficial, especially where it compelled bad employers to adopt appliances, which, under a voluntary system, would only be adopted by the best employers. But all the progress is not due to legislative interference; much of it is the result of voluntary efforts, the spread of technical knowledge, the growth and application of science and the natural development of humanitarian ideas.

When legislation was first started in the interest of miners, the output of coal per person employed in and about mines ranged between 250 and 270 tons per year. In those days mining appliances were of necessity primitive, and working conditions were shocking compared with those of today. A large proportion of the workers, even below ground, were small boys, girls and women, while the men were far inferior in health and physique to those of the present generation.

Now, few women are employed about the mine and none below ground, and no young children are employed. Wages are fully 50 per cent. higher per worker now than then; the mines are better drained, propped, lighted and ventilated; comfort and safety have been vastly improved, and appliances and methods are much better than they were 60 years ago. Notwithstanding these facts the annual per capita output of coal does not reach 300 tons.

Labor Cost Increased

The fact stands out clearly that individual effort has lessened, when it should have increased. The actual labor cost of coal production in this country, apart from the higher capital and fixed charges, has gone up from an average of about 3s. 6d. to 6s. per ton in the last 50 years. A moderate estimate of the increased cost of coal production due to legislation is 2s. per ton. This increased cost of coal is the price paid, not unwillingly, for the enforcement of safe working conditions in our mines. It is the price the British coal consumer pays for state protection of the coal miner. These state-imposed regulations relating to safety devices, etc., coupled with science and inventions, have, however, reduced our mining-accident death rate by about two-thirds in 50 or 60 years.

At the present time it would seem that state interference is doing more harm than good. After two generations of steady decline in the mining-accident rate the period of increasing accidents is now entered and this is not altogether independent of recent legislation. In 1899 the death rate was as low as one in every 840 employed, while in 1909 it was increased to one in every 698. Among the reasons for this increase in the death rate may be mentioned the wider application of electricity to coal mining without the employment of competent staffs of electricians to control the installations, and the change in the life and habits of miners. Most of the young miners are no longer content to spend their evenings in the villages. Taking advantage of cheap transportation they go to the city to seek amusement. Late hours with insufficient sleep has a tendency to unfit

them to cope with the dangers of their work, and an increase in the number of accidents is the result.

There is a marked growth of lawlessness among miners and increased friction between men and employers; strikes over trifles are not infrequent. Then there is the question of state supervision; in some directions there is too much and in others not enough. There are too many laws of an inflexible nature, sufficient allowance not being made for the varying natural conditions. These have the effect of checking initiative and of placing upon the state the responsibility of safeguarding the workers rather than upon the managers. Further, there are not enough inspectors to see that the various laws are enforced. Mine inspectors are so few in number that they seldom visit the pit save in case of accidents. The inspector should be frequently on the spot in order to prevent accidents.

Workmen's Compensation Bill

The Workmen's Compensation Bill of 1897 has not brought about the diminution in accidents it was expected to accomplish. The law was too hard, for it insisted upon the same rates of compensation for old and feeble workers as for young and strong workers. The owners, consequently, gave preference to the younger men, and weeded out the elderly workmen who were really the cautious, experienced and safe men. A speeding-up system was established resulting in a large increase in accidents.

The Eight Hour Law

It is probable that the Eight Hour Law will have a tendency to increase the risks of mining. During the first six months under this law there was an increase of 26 per cent. in fatal accidents in the coalfields of South Wales. There will be an acceleration in haulage and windage where possible. The miners will attempt to overcome the reduction in their earning time by giving less attention to propping, etc. These men work mostly by piece or by ton, and with fewer hours allowed them for making wages they are likely to rush over their work. Further, there is the loss to the elderly pitman. Formerly, these men managed to make wages by entering the mine earlier, and leaving it later, than the younger and more active men. The new law destroys this liberty.

Likewise the manager will have no option but to give preference to the young and vigorous men who can get out the most coal in the least time. Consequently, the aged miners will have to go and more accidents will be the inevitable result. This increase in accidents will result not only from the substitution of inexperienced and reckless men for the experienced and careful men, but from the loss of the vigilance which the aged pitman exercises and the valuable advice which he gives to his younger mates.

Under the new act sufficient time is not allowed for repair work. Formerly the repair gang worked 12 or 18 hours to get everything in safe condition before the hewers started work. Now the repairmen are not allowed to be in the mine more than eight in any 24 hours. The result is that repair work is slighted and the miners are exposed to greater danger.

Miners Disappointed in New Law

Aside from the question of increased accidents, the miners in many districts are bitterly disappointed with this law which they were told would be a great boon to them, and are asking to go back to the conditions prevailing before the measure was enacted.

In some districts, where the mines were worked on single shifts, giving the men regular hours of work, rest and meals, it is now necessary to work on a double- or treble-shift system. Also, miners were formerly in the habit of working three or four long days and one short day per week with an extended week-end clear. Now, since they cannot work long days, Sunday is their only free day.

The owners also find their costs increased, due to the larger number of short shifts in place of the smaller number of long shifts and profits are seriously cut down. But that is another matter. The purpose is to point out that some of the recent legislation in the supposed interest of the miners is proving detrimental to the men, particularly in the matter of increasing their risks.

The Altofts Experiments

Mention may now be made of the latest act of mining legislation, the Mine Rescue and Aid Act, and the movement which led up to it. About 12 years ago, W. E. Garforth, manager of the Altofts colliery in Yorkshire, who had spent much time experimenting with coal dust and other explosives, began to devote special attention to the problem of rescue work in case of fire, explosions, etc. At that time the best known apparatus for enabling men to breathe and work in noxious gases, was of German make. Mr. Garforth secured samples but soon discovered imperfections. It was sought to test the apparatus in conditions as nearly like those that prevail after a disaster as is possible. The colliery owners assisted Mr. Garforth and his colleagues financially. A large experimental gallery was constructed, filled with deadly fumes and obstacles put in to represent fallen roofs, etc. Then a rescue brigade of miners was organized and the work begun.

It was not long before the Altofts experiments were attracting considerable attention. Mining engineers and scientific men from various parts, including the continent and even America, visited the Yorkshire station, where not only rescue work but coal-dust experiments were conducted on an elaborate scale. A stimulus was given inventors who set about devising improved apparatus and, although it can scarcely be claimed that perfection has been attained, considerable improvement has been effected in breathing appliances. Knowledge of explosions has been extended and the rescue station has served as a model for others in various parts of the country. There are now 10 fully equipped rescue stations and brigades in England, Scotland and Wales and at least another dozen are in course of organization.

Mine Rescue and Aid Act

As a direct outcome of this work, the above mentioned Mine Rescue and Aid Act has just been passed, empowering the state secretary to order the provision of rescue apparatus and the organization of brigades in those districts where the mine owners have not provided such facilities voluntarily. In this matter of compulsion, however, the example of the continent is being followed, for in Austria, Germany, France, Belgium, Holland and Russia the provision of rescue appliances is required by law.

Another continental idea which may possibly be adopted in this country is the provision of safety chambers or refuges for the miners in case of fire or explosion. Interesting experiments in this connection were conducted in France, as a result of which several French owners are putting "blind galleries" supplied with compressed air, food and water in their pits. If efficient breathing apparatus were put in the pits for the use of the men below as well as for the rescue brigade these refuges would prove of practical utility. What is really needed is something to enable the entombed men to live and escape, quite as much as something to enable rescuers to get down into the workings, only in most cases to find the men dead.

One inventor of rescue apparatus in this country has put on the market what he terms a self-rescue appliance which can be kept below ground ready for use and if a man can secure one of these before he is overcome by foul air he can keep alive for at least half an hour. This seems a step in the right direction. With the entombed men supplied with breathing apparatus working their way toward the shaft and at the same time the rescue brigade making their way inward, many lives might be saved.

It must be remembered, however, that comparatively few accidents are due to fires or explosions, most of them being the outcome of falls of roofs. In watching for faults and in timely propping, the greatest care is needed. It is of li

tle use for the state to pass measures for the provision of rescue and ambulance appliances and for compensation in case of injury to workmen, if at the same time it enacts laws such as the Eight Hour Bill which adds seriously to the dangers of the industry due to "speeding up," the neglect of repair work and other precautions, and the elimination of the elderly and most experienced men.

Oklahoma's 1910 Coal Production

Oklahoma's coal production in 1910 was 2,646,226 tons, valued at $5,867,947, a decrease of 473,151 tons as compared with 1909, according to Edward W. Parker, of the U. S. Geological Survey.

Oklahoma was one of the States most seriously affected by the prolonged strike of 1910. After mining was generally resumed in September there was a strong effort made by both operators and miners to make up for lost time. The actual loss in production was, therefore, not in proportion to the time lost by the strike.

There has been a strong tendency on the part of the miners to use increased quantities of powder, and it is also stated that dynamite is frequently used, a practice which is not only dangerous to life and property, but results in a largely increased percentage of slack. Moreover, it is the practice in nearly all the mines to "shoot off the solid." This also is hazardous and has increased the quantity of slack so that it is now double what it was 15 years ago. The coal industry of the Southwest has suffered also from the continued competition of cheap fuel oil and of natural gas.

The number of men reported as employed in the coal mines of Oklahoma in 1910 was 8657, who worked an average of 144 days. The number of men on strike was 8213 and the average time lost by each man was 152 days. The quantity of coal produced for each man employed in 1910 was 306 tons for the year and 2.13 tons for each working day.

The coal-bearing rocks of Oklahoma form a part of what is known as the western interior coalfield. They extend from what was Indian Territory into Kansas on the north and into Arkansas on the east. Within the State this field has an approximate area of 20,000 square miles. The total area underlain by workable coal is estimated to be about 10,000 square miles.

The coal deposits, of which there are 10 or more beds, vary from a medium-low to a high-grade bituminous, approaching semianthracite. Some of the high-grade bituminous varieties possess coking qualities. Several hundred coke ovens are in operation in the eastern and western parts of what was the Choctaw field. Much of the slack that is produced is washed and turned into coke.

Ohio's 1910 Coal Production

Ohio's total production of coal in 1910 was 34,209,668 tons, with a value of $35,932,228, according to Edward W. Parker, of the U. S. Geological Survey. Although more than half of the coal miners of Ohio were on strike in 1910 for a period equivalent to 25 per cent. of the average number of days worked, the increase in production in 1910 over 1909 was the largest gain ever made in one year. The increase in 1910 was 6,270,027 tons, or 22.44 per cent. It was due principally to the long continued idleness in the States to the west, but in addition the cold winter of 1909-10 had cleared the Lake docks in the Northwest of coal, so that the year opened with a good demand for Ohio coal, and there was unusual activity during the year, except for the comparatively short time of the strike in the organized mines and during two local strikes.

Ohio continues to lead in the percentage of the total production undercut by the use of machines, and in 1910, 28,887,241 tons, or 84.44 per cent. of the total, was machine-mined. The number of men employed in the coal mines of Ohio in 1910 was 46,641, who averaged 203 working days. The record for efficiency among the miners in Ohio is high. In 1910 the average production by each man employed was 733 tons for the year and 3.61 tons for each working day. George Harrison, the State mine inspector, reports that in 1910 there were 161 men killed and 471 injured in the coal mines. The death rate per thousand was 3.45 and there were 212,482 tons of coal mined for each life lost.

Illinois Coal Production

The total production of coal in Illinois in 1910, as compiled by Edward W. Parker, of the U. S. Geological Survey, in coöperation with the Illinois Geological Survey, amounts to 45,900,246 tons, valued at $52,405,897, as against 50,904,990 tons in 1909.

Illinois was the storm center of the struggle between the operators and mineworkers, which began April 1, 1910, and tied up the industry in most of the mining districts of this State for nearly six months. The strike was ended by the practical surrender of the operators to the demands of the workmen, whose cause was aided by the fact that the strike was limited to Illinois and the Southwestern States and the markets for these coals were being supplied from the product of competing States.

With the mines in most of the coal-producing counties shut down for practically six months of the year, a decrease of from 20 to 30 per cent. in production might have been expected, but as a matter of fact the decrease was less than 10 per cent. The decreased production in Illinois and a big increase in West Virginia gave the latter State in 1910 a lead over Illinois of more than 15,000,000 tons and has apparently established West Virginia as second in rank among the coal-producing States.

In 1910, out of a total of 72,645 men, 67,218 were idle for an average of 136 days. The State bureau of labor statistics, David Ross, secretary, reports that in the fiscal year ended June 30,1910, there were 390 fatal and 737 nonfatal accidents in the coal mines of Illinois. In 1909 there were 213 fatal and 896 nonfatal accidents.

Accident at Marvine Mine

SCRANTON CORRESPONDENCE

Owing to the breaking of a wire rope attached to a trip of loaded cars and the failure of the "drag," a safety appliance, to act, three men were crushed to death in the Marvine colliery of the Delaware & Hudson company on Tuesday afternoon, Sept. 12. Two other men had a marvelous escape from death but were severely injured. The officials of the mine are unable to account for the breaking of the rope or the failure of the drag to act. They assert that no mining law was violated, and that no person is directly or indirectly to blame for the tragedy. The rope was almost a new one, having been in use only six months, and the drag when last inspected was apparently in perfect condition. There will be a coroner's inquest, at which the report of the mine inspector on the tragedy will be read.

The slope, down which the trip of cars traveled after the rope broke, is 1600 ft. long. The cars at the moment of the accident were near the top of the slope. The five men, who were affected by the accident, had left the manway and were walking up the slope, when the rope broke. Before the men could realize what had happened, the cars were upon them. Two of the men managed to step aside and were only lacerated by the cars. Their three companions were ground to pieces. It became known immediately at the hoisting house that the rope had broken. A rescue corps was organized and rushed to the foot of the slope. Mine ambulances and surgeons were called and the injured men taken to the State hospital.

In the coal-mining districts of Australia efforts are being made to provide adequate means for rendering first aid to miners injured in accidents. In New South Wales 20 collieries are now equipped with ambulances, an important adjunct, especially at mines at a distance from hospitals. The Queensland department of mines is investigating the respective merits of the Fleuss apparatus and the Draeger with a view to equipping the rescue station at Ipswich with efficient rescue appliances.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

M. H. Kuryla is at San Sebastian, Jalisco, Mexico.

G. F. Beardsley has gone to Monterey county, California.

A. K. McDaniel was in San Francisco and has gone to Cananea.

Thomas Kiddie, of Vancouver, B. C., was in San Francisco lately.

Edward L. Dufourcq has returned to New York from California and Mexico.

J. Parke Channing was recently in Spokane, Wash., on his way westward.

A. P. Dumas is with the Mina la Cruz y Anexas, at Zimapan, Hidalgo, Mexico.

Courtenay De Kalb has been in San Francisco and has gone to Tucson, Arizona.

S. E. Bretherton, of San Francisco, will visit Denver about Oct. 1, but will return about Oct. 10 to San Francisco.

W. J. Woolsey, consulting engineer of Thetford Mines, Quebec, has gone to London on professional business.

Judge E. H. Gary, chairman of the board of directors of the United States Steel Corporation, has returned from Europe.

Walter Harvey Weed has been appointed consulting engineer in active charge of operations of the Interstate Silver-Lead Mining Company, at Wallace, Idaho.

Clyde T. Griswold, formerly of the University of Colorado, has been appointed assistant professor of mining engineering in the Carnegie Technical school.

Willis L. King, vice-president of the Jones & Laughlin Steel Company, is in New York this week, on his return from Europe. He will leave for Pittsburg next week.

A. P. Rogers, who has been engaged on professional work in Brazil during the last eight months, is now in London; from there he will return to his New York offices.

F. O. Ellenwood, of the mechanical-engineering department of Stanford University, California, has accepted an appointment in the Sibley College of Engineering at Cornell.

T. C. Crawford, president of the United Gold Mining and Milling Company, sailed for London and Paris on Sept. 13. He will return to California late in January of next year.

M. W. Summerhayes has resigned from the management of the Swastika mine, to devote himself to private practice at Toronto, with offices at 76 Home Life building, in that city.

William Fleet Robertson, provincial mineralogist, returned to Victoria on Sept. 3, after having done two months' field work in the district about Hazelton, in the Skeena River district.

William H. Armstrong, for many years mill superintendent for the Dos Estrellas Mining Company, at El Oro, Mexico, has joined the sales force of the Mexico Mine and Smelter Supply Company, at Mexico City.

Ernest Levy, manager of the mines of Le Roi No. 2, Ltd., at Rossland, B. C., and the Van Roi Mining Company, in Slocan district, has returned to British Columbia after having been in England several months.

William E. Corey, formerly president of the United States Steel Corporation, has left New York for a trip to Mexico and Arizona, in company with John D. Ryan, president of the Amalgamated Copper Company.

T. H. Hogg, formerly with the Temiskaming & Northern Ontario railway, and more recently with the Hydroelectric Commission of Ontario, has been appointed managing editor of the *Canadian Engineer*, of Toronto.

Chester B. Allen, superintendent of the Tarantula mine of the United Gold Mining and Milling Company, has been appointed general manager of all the company's interests in California, with headquarters at Chinese Camp, Tuolumne county.

Milton Fies, general superintendent of coal mines of the Birmingham Coal and Iron Company, has resigned. Oct. 1 Mr. Fies will go to the Pratt Consolidated Coal Company and will be in charge of the Banner mines when the State places its convicts there.

Francis H. Shepherd has resigned the office of chief inspector of mines for British Columbia to accept the Conservative nomination for the coal-mining constituency of Nanaimo, in opposition to the late member, who is a supporter of the Federal Liberal government.

President Taft has appointed the following delegates at large to the American Mining Congress: John Hays Hammond, Dr. J. A. Holmes, George Otis Smith, Washington; George S. Rice, Pittsburg; F. W. McNair, Houghton, Mich.; Robert N. Dickman, Chicago; C. H. Lindley, San Francisco; Frank H. Crockard, Birmingham, Ala.; J. Parke Channing, W. R. Ingalls, New York.

Albert E. White has resigned as superintendent of the Jones & Laughlin Steel Company ore-dressing experiment station in Pittsburg to accept a position tendered him by the University of Michigan to give the courses offered there pertaining to the metallurgy of iron and steel. It is his intention to devote some of his spare time while there to consultation work, particularly along lines relative to the dressing of iron ores.

OBITUARY

M. J. Quinn, superintendent of the Minooka colliery, near Scranton, Penn., was killed Sept. 18, by the fall of roof in the mine.

Christian Otto Brunner died at Bethlehem, Penn., Sept. 7, aged 80 years. He was born in the house in which he died, and was educated in Bethlehem. On July 12, 1860, he was engaged by the then infant Bethlehem Iron Company as its first employee, taking charge of the hands, keeping time, making payments and acting as bookkeeper. Soon after he was appointed acting treasurer, and so remained until July, 1870, when he was elected treasurer of the company. In this position he remained, being continued in it by the Bethlehem Steel Company, until Sept. 1, 1911, when, after a service of 41 years as treasurer, and 51 years with the company he tendered his resignation.

SOCIETIES and TECHNICAL SCHOOLS

American Mining Congress—The fourteenth annual meeting has been postponed. The convention will be held at the Hotel LaSalle, Chicago, Oct. 24 to 28, inclusive, instead of Sept. 26 to 29, as previously announced. The action of the directors in determining on a later date was based upon several important reasons. President Taft was unable to attend on the first date chosen, but informed the Chicago committee that he would be glad to address the convention on his return trip from the West. Coincident with the receipt of this information arose the possibility that neither Secretary Fisher nor Doctor Holmes would be able to reach Chicago by the latter part of September. The Alaskan chapter urged a delay in order to send a stronger and more representative delegation. The presence of a number of governors was assured in the event of a postponement.

The convention will occupy itself with the following general subjects:

1. The prevention of mining accidents.
2. Workmen's compensation for the victims of mining accidents.
3. The prevention of waste of the natural resources and conservation of the energy which now contributes to coal production.
4. The general problems of the bituminous coal-mining industry as intensified by the demand for the better protection to miners and the conservation of fuel resources.
5. The Alaskan question.
6. The public lands questions of the West as they affect the mining industry.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

Sept. 13—Experiments in the use of chemicals in the separation of gold and copper from sulphide ores are to be made at the University of California under the direction of Prof. Edmund O'Neil. The fact that the Cottrell process for neutralizing smeltery smoke has not proved wholly satisfactory induces Professor O'Neil and others to conclude that successful and economic treatment of sulphide ores by the smelting process, without the injurious effects of escaping gases, cannot be accomplished. Since a number of students of the university will be selected to assist in the experiments and tests, the effort will be at least valuable in affording experimental and comparative study, and will doubtless add to the general knowledge of applied science. The Cottrell process has so far satisfied everyone whom it concerns, except the farmers whose farms are of little value in a mining district without miners, since the market for the products are dependent on the consumption of the mining population; and the conservationists who are more concerned about the preservation of scrub timber than in the advancement of a great mining industry.

The formal invitation to be extended to President Taft to turn the first shovelful of dirt in breaking ground for the Panama-Pacific exposition at San Francisco is to be engraved on gold to be taken from the Empire mine in Nevada county. The Empire has the reputation of being the oldest quartz or vein mine in the State, which is not true; although it is probably the oldest mine now being worked. Quartz mining was begun in Mariposa county in 1852, in Sierra and Shasta counties in 1853; but in 1861, the year which marked the beginning of successful quartz mining, when the output of the mines in the State reached $6,000,000, Grass Valley, the home of the Empire, produced 25 per cent. of the total; and the Empire was one of the producers and has ever since been. By reason of a long, continuous and profitable existence that mine is certainly entitled to furnish the gold plate bearing the invitation to the President to come and shovel dirt.

Denver

Sept. 12—A. E. Carlton, one of the directors of the Cripple Creek Drainage and Tunnel Company, has announced that the money necessary to continue the work has been raised and that work has been started; whether the tunnel will be driven straight ahead into the breccia area, or follow some of the dikes in the granite, has not yet been announced. The former of course is the only plan which can possibly be of advantage to the entire ore-bearing area. Engineer Countryman gives the flow from the portal as 5800 gal. per min. The tunnel was started in 1907 and is in now about three miles from the portal and while it is not altogether the success that was predicted, it has been of sufficient advantage in draining the mines, to encourage the mine operators of the district to furnish the money necessary to continue the work. The average recession of water in the mines is stated to be about five feet per month, except in the rainy season.

It is stated that the Moffat Coal Company has been formed, the personnel of the incorporators being the same as the Oak Hills Coal Company, the latter having been absorbed by the former company. The new company which owns and has been operating the Oak Creek bituminous mines on the Moffat road, is commencing to develop the Crawford anthracite tract which was acquired by a judgment deed from the county commissioner of Routt county under foreclosure sale; the property was formerly owned by the Yampa Fuel and Iron Company, which was unable to complete its payments. At present the anthracite area of Pilot knob, and which covers about 40 square miles, is distant about 18 miles from the railway at Steamboat springs, the present terminus of the Moffat road, about 50 miles from the end of the Saratoga & Encampment railroad, a feeder of the Union Pacific on the north and about the same distance from the Laramie Hahns Peak & Pacific railroad, also a feeder of the Union Pacific.

The commissioner of mines of Colorado, T. B. Henehan, has returned from a trip to the San Juan region, and reports that an English corporation known as the International-Liverpool Company has been mining carnotite ore from the deposits near Paradox and Placerville in San Miguel county since April last, and secretly shipping it to Liverpool via New York; 20 four-horse teams were employed in the work with a cost for wagon haulage alone of $18 per ton. It is believed, he says, that the value of the ore shipped is from $100 to $300 per ton in uranium and vanadium.

Butte

Sept. 13—A new and higher rating for the treatment of highly silicious ores, brought in from the surrounding independent mining districts, has been put into effect by the Washoe smeltery at Anaconda. In the past, ores running in the neighborhood of 90 per cent. silica have been treated for about $3 per ton, but this has been discontinued and the present rates are as follows: Pay for 90 per cent. of the silver if less than 100 oz. per ton, and for 75 per cent. of the silver if 100 oz. or over; pay for 90 per cent. of the gold if less than $20 per ton, and for 95 per cent. if $20 or higher. Treatment cost is $5 per ton if the gross value of the metals is less than $12; the cost is $5.50 if the gross value is $12 or under $15, and $6 if the gross value is $15 or higher. The rate is the same on concentrates and iron sulphides, except that 10c. is allowed for each per cent. of iron in excess of silica.

The American Smelting and Refining Company's smeltery at East Helena is practically the only customs plant in Montana and Idaho, and owing to the recent impetus given to the mining industry in Montana, the plant today is taxing all of its resources to treat the ore brought to it. Most of the silver, lead and gold ores from Montana and Idaho are treated here, an average of 500 men being employed steadily at a wage disbursement of between $35,000 and $40,000 per month. Seven hundred tons of ore per day, or 20,000 tons per month are reduced, and gold, silver and lead bullion is shipped to the extent of $650,000 per month. In freight charges on ore received and bullion shipped, $725,000 are paid to the railroad companies annually. The plant is equipped with four waterjacket blast furnaces, each having a capacity of 175 tons of ore per 24 hours, and a group of 16 reverberatory roasters, 14 ft. wide and 44 ft. in length. Also, the Huntington-Heberlein process was installed a few years ago, the ore by this process being partially roasted first in four revolving circular Godfrey furnaces, and then in 12 converting pots, by which method 260 tons of ore per day are cared for. A year ago a Dwight & Lloyd furnace was installed, which proved so satisfactory that two more have been added since, and a third is now being put in to be ready for use by October 1; the first of these has a capacity of 45 tons and the last three of 85 tons per day. A new steel automatic sampling mill, at a cost of $50,000, is now being erected; the old plant, which has been

used almost since the establishment of the smeltery, over 20 years ago, is of much too small a capacity to care for the ore now being received, and this mill will be in operation early in November. An average of 4500 tons of lead bullion, containing about 100 oz. of silver and 1 to 2 oz. of gold per ton, it shipped per month, but in the month of August just ended, 5200 tons of bullion were shipped, establishing a new tonnage record for the East Helena smeltery.

Salt Lake City

Sept. 15—The production of the Utah Copper Company for the first seven months of 1911 is given as 53,321,919 lb. as compared with 52,447,851 lb. for the same period of 1910. The output in July was 7,555,407 lb. Recently the company has added to its dumping ground by the purchase from the Bingham Amalgamated of 10 acres in McGuire's gulch. Train service over the Bingham & Garfield line has been started, the first train of empties being sent over to the shovel pits Sept. 6. Passenger and freight service between Salt Lake and Bingham was commenced Sept. 15, the Salt Lake Route furnishing the coaches and equipment. Two trains per day will be run each way, and later it is proposed to run a third. Trains leave Salt Lake from the Oregon Short Line station. The Bingham depot is 500 ft. above Carr fork, and a walk consisting largely of stair steps, so as to make the climb as easy as possible has been completed. Parallel with this is an inclined elevator or tram which connects the depot on the hill with the street level, and will be used to haul passengers and light freight.

During August a larger tonnage was sent out from Park City than for some time; 186 cars or 7166 tons of ore were shipped over the Denver & Rio Grande to the different smelteries or out of the State. In addition to this, 126 cars or 5015 tons, were shipped over the Union Pacific, making a total of 12,181 tons for the month. The Daly West shipped 3776 tons; Daly-Judge, 1830; Silver King Coalition. 3891; Little Bell, 1466; Grasselli Chemical, 486; E. P. Evans, 58 tons. The average shipments range between 7000 and 8000 tons per month.

An excursion of brokers and mining men to Pioche has been arranged by the Salt Lake Stock and Mining Exchange over the San Pedro railroad, Sept. 15. The exchange will remain closed Friday and Monday, which will allow a three days' inspection of the Pioche district. A special train will leave at three o'clock Friday afternoon, and will be run through without change to Pioche, where it will be sidetracked to serve as quarters for the party. About 50 men, including a delegation from the Salt Lake commercial club, have made arrangements to go, and it is thought this number will be nearly doubled.

Birmingham, Ala.

Sept. 16—Beginning Oct. 1 the Banner mines of the Pratt Consolidated Coal Company will be worked by convicts under the new system. The State officers will have entire control of the men, and the Pratt company will buy the coal, paying the State the current wage rate for the men. The mines are thoroughly equipped with electricity and the general engineering work underground has been the best possible. The haulage system is good, the ventilation thorough, and every other part of the work in the best of shape. It is expected that with 400 State convicts the output at this place will never be under 1800 tons of coal per day.

The big dam, lake and waterworks system of the Tennessee Coal, Iron and Railroad Company, started last year and costing more than $1,500,000, are completed and water is now being pumped to the various plants of the company around Ensley. The company has been buying water from the Birmingham waterworks besides pumping, when the water was not too low, from Five Mile creek, near Ensley. The dam and lake will furnish not only water enough for the Tennessee company's own plants but for subsidiary corporations and others desiring it, the waterworks system having a daily capacity of 32,000,000 gal. per day. The dam, lake and waterworks are a fine engineering work and mean much for the Birmingham district. There never will be any further complaint as to the water supply in the section of the county with Ensley as the hub. Two steel plants heretofore were lost to the district because of the inadequate water supply, or rather because the water cost was too high.

Goldfield

Sept. 16—At present the confidence among mining men in the camp's resources and its future is greater than possibly at any time during its history. The recent formation of the company headed by W. A. Clark and the announcement of the plans of this company are in a great measure responsible for this feeling. The fact that other companies are planning operations in parts of the district somewhat distant from the producing sections is somewhat noteworthy. The knowledge that good ore has been exposed at depths of about 1200 ft. vertically and the gradual increase in the circle of operations has dispelled the fear, entertained by many at first, that the enrichment was superficial and that the camp would be a short-lived one.

Negotiations are reported to be under way, whereby Eastern and Western men are attempting to secure control of several companies, known among the non-producers, and which have undergone only a limited amount of development. An interesting feature in this connection is the probable fate of some of the companies, organized as nonassessable, and which are unable to raise further funds for development. The question of organizing assessable or nonassessable companies has long been a subject of discussion among mining men in the camp. Herman Zadig, of San Francisco, has, for several years, advocated the assessable form of organization and now has a large following of supporters. The practical success of the system is believed to have been demonstrated in the case of the Mexican company at Virginia City, the Rescue-Eula at Tonopah, and the Conqueror Consolidated, Sandstorm-Kendall Consolidated and Diamond-Black Butte Consolidated, at Goldfield.

Among the properties now involved in negotiations that may result in their being developed on a more extensive scale than heretofore, are the Goldfield-Kewanos, Atlanta, Lone Star, Blue Bull, Commonwealth, Black Butte Consolidated and Goldfield-Vernal. The last named is already financed by Philadelphia men. Details of the plans will probably be announced within another month.

Toronto

Sept. 15—The new gold camp at West Shining Tree continues to attract a large influx of prospectors, who have been going in at the rate of over 100 per day. The Canadian Northern Railway extension, which is being constructed rapidly will be within 15 miles of the district in a few weeks, rendering it easy of access. The townships of Churchill, McMurchy, Asquith and Fawcett are being staked out and have been largely taken up. It is stated that the Gosselin property, on which the first find was made, situated in Churchill township, has been bought by Mackenzie & Mann, of Toronto, for $300,000. The Dome interests have representatives on the spot.

An important find of asbestos is reported in the Kenora district. W. C. Richards made the discovery on Falcon island, Lake-of-the-Woods. The vein which yielded some fine samples on the surface is 60 in. wide and has been traced for half-a-mile. It occurs in the neighborhood of a mica deposit believed to possess considerable commercial value.

The survey of the steamboat mountain gold district in British Columbia, by the Dominion geologists, has been completed and it is understood that an unfavorable report will be presented. This district was the scene of considerable excitement, due to the reported discoveries of large and important orebodies, and many claims were staked. Several properties were opened up but the orebodies were not found to be so rich as expected and the district has fallen flat. Within 30 miles of Steamboat mountain there are, however, some silver-lead deposits that are considered promising.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

The largest stampede that Seward has experienced for a long time is now on to Sunrise, on what is known as the Arm. J. D. Meenach, of Seward, has taken an option on a number of claims. Word has reached Skagway of the discovery of a placer field near Lake Marsh, Yukon territory. Telegraphic reports indicate that the strike is genuine, and a rush is on.

Barrack-Girtwood—Stephen Birch, Latouche, has taken option on this property adjoining the Beatson copper mine. A force will be put to work at once, and operations continued on a larger scale than heretofore.

Alaska Treadwell—For the month ended Aug. 15, the 240-stamp mill and the 300-stamp mill crushed 83,412 tons of ore, yielding $225,534 gross and net $135,732. Operating expenses were $89,801, and construction, $15,701. The ore averaged $2.77 per ton.

Alaska Industrial—The company has a large force at work on its property at Sulzer, and is contemplating installing additional drills. Charles A. Sulzer has charge of the work.

Kenai-Alaska—The first cleanup has been made at this mine. Sixty-five tons of ore taken from the stopes above the lower tunnel returned bullion amounting to 198 oz., the assay value being $18.75 per oz. James R. Hayden, Seward, is in charge. An aërial tramway will be installed this autumn.

Dolly B—Clark & Wilson, owners, have a force employed driving a tunnel on this property at Skagway.

Guthrie-Belloli—This property, near Valdez, is to be equipped with modern machinery in the spring. F. G. Guthrie is interested.

Arizona

Gila County

Miami—The company is employing about 590 men, 300 underground, 200 on surface and 90 in the mill. Seventeen hundred tons per day are being mined, of which 600 tons come from development, 200 tons from the dump and 900 tons from mining operations. Square sets are being placed next to the capping preparatory to the top slicing of the irregular portions of the orebody and three rooms are under way by the room-and-pillar sublevel stoping method. No timber is used in the rooms and the ore is broken cheaply. Three and a half sections of the mill are handling 1700 tons per day and equipment is being rapidly installed in the other 2½ sections. The Burch rolls, which gave trouble at first, owing to their high repair cost, are said to be giving satisfaction now. The salient feature of a lateral movement to one roll has been retained but the mechanical application of the motion has been changed and the speed somewhat reduced without lowering the capacity. The fine grinding in one-half of the fourth section is being done with an 8-ft. Hardinge pebble mill instead of a chilean mill as used in the first three sections. The other 2½ sections will probably be equipped with Hardinge mills. A 75 per cent. recovery is reported and 75 tons of concentrates per day averaging 42 per cent. copper are being shipped to Cananea, with an average production of 1,800,000 lb. of refined copper per month.

Inspiration—All underground development and churn drilling have been discontinued. A dam site for a pumping station has been selected at Wheatfields on Pinal creek, 12 miles from the mine. Thirty men are working on a road at that place and a survey is being made for a pipe line to the mine. Surveys for a millsite are in progress near the mine and the Arizona Eastern railroad is making a survey for the extension of its track to the property.

Keystone—Underground development has not yet been resumed. One churn drill is in operation on hole No. 36 about 500 ft. west of the shaft. The hole has passed through the granite porphyry and is now in the schist.

Live Oak—Five churn drills are in continuous operation near the western boundary. Shaft No. 2 near the western end of the property penetrated the orebody at a depth of 705 ft. and is now down about 765 ft. The crosscut to the orebody from No. 1 shaft is in about 550 ft. westward from the shaft. Twenty tons per day of copper-silicate ore are being shipped to the El Paso smeltery from the dumps of the old workings. It is the intention of the management to ship 1000 tons of this ore.

Southwestern Miami—Churn drilling is going on steadily. The property consists of 18 claims adjoining the Live Oak on the latter's southwestern boundary and which appear to be on the line of the general trend of the Miami-Inspiration ore zone. A No. 23 Star drill is putting down No. 1 hole which is located about 500 ft. from the nearest drill on the Live Oak ground. Owing to the unusual depth at which the ore was encountered in the adjoining Live Oak ground, the management expects to have to go 50 to 150 ft. deeper before striking ore.

Summit—At the mine, development is confined to the Pasquale vein and all hoisting is done through the vertical shaft. Five stopes are being worked: One on the north 200-ft. level, one on the north 400-ft. level, and three on the south 400-ft. level, of which one is below the level. A prospect shaft is being sunk on the vein about 800 ft. south of the portal of the Pasquale tunnel, and is down about 50 ft. Some good carbonate and chalcopyrite ore has been taken out and the shaft is being deepened. About five cars per month of chalcopyrite ore averaging 20 per cent. copper are being shipped to the El Paso smeltery. Thirty men are employed.

Cole-Goodwin—This old mine in the Pinal mountains, 20 miles southwest of Globe, and under option to the Globe Western Copper Company, which started operations last month, is being developed by a force of 18 men, working two shifts. Two 6-horse teams are engaged in hauling ore and supplies. The vein is a mineralized fault in the Pinal schist with an outcrop traceable for 6000 ft., and is developed by a tunnel 200 ft. long and a shaft 420 ft. deep, from which 380 ft. of drifting has been done on three levels. Drifting is now in progress on the 300-ft. level and a station is being cut at the 400-ft. level. The drift and the shaft are in low-grade ore, from which some high-grade is sorted and shipped. The foot wall is mineralized for an unknown distance and will be explored. The ore is pyrite and chalcopyrite in a silicious gangue.

Arizona Commercial—Development work has been discontinued, pending action on the plan of consolidation with the Superior & Boston. Pumping continues and the railroad remains in operation.

Kingston—Fifty tons of ore per month are being shipped from this group, three miles east of Globe and adjoining Superior & Boston and United Globe ground. The group of six claims is owned by Captain Wiley and associates, of Globe, and is under lease to Fred Dixon, Jack Carpenter, *et al.* It is developed by a shaft 290 ft. deep and numerous drifts and tunnels. The ore is mostly silicious,

carrying 6 to 7 per cent. copper, a few ounces of silver and 70 per cent. silica, and is used for converter lining by the Old Dominion smeltery. Some high-grade ore is shipped, running 10 to 12 per cent. copper.

Superior & Boston—Development work is confined to the McGaw shaft and the Great Eastern vein. The shaft has 60 ft. to go to reach the 1200-ft. level, where a station will be cut. The raise from the 1000-ft. level has been holed through to the 800, and the winze from the same level has attained a depth of 60 ft. A crosscut from this winze at a point 35 ft. below the level showed a width of 19 ft. of ore without reaching the hanging wall. A special meeting of the stockholders has been called for Sept. 30 at Globe, to act upon the proposed plan of consolidation with the Arizona Commercial.

Ray Central—Since the new management took control in November, 1910, development has been largely confined to drifting on the fourth level, though some churn drilling has also been in progress. The results of this development work have induced the management to make plans for operations on a permanent basis. Frank H. Probert will go to New York the latter part of September to consult with the directors regarding these plans.

California

Amador County

Central Eureka—Ore is being extracted from the 2500-, 2700- and 2800-ft. levels; the orebody in the 2800 is 30 ft. wide. The mill has resumed after a three-weeks shutdown for shaft repairs.

Rose—The shaft in this mine near Sutter creek, is down 300 ft. and the drift is in 500 ft. A new electric pumping plant is contemplated.

Sierra Ranch—This gravel mine is to be reopened, after 20 years idleness, by Albert Martell, J. M. Hendriksen, and H. M. Hale, of Sutter Creek.

Mono County

Mono Diggings—Thomas Donohue, representing John Hays Hammond and E. A. Wiltsee, visited this property recently; prospecting with a Keystone drill is contemplated and the installation of a dredge may follow should the prospecting warrant.

Golden Gate—A new stamp mill and electric plant have been ordered and will be installed in October.

Placer County

Herman—A stamp mill and two compressors were recently installed. Present development is by shaft. Fifty men are employed. E. B. Quigley, is superintendent.

King Solomon—This mine and power company is working Munford bar near Westville. A hydraulic plant will be installed, and if the ground warrants a dredge will be built. William Haase is manager.

Plumas County

Antlered Crest—The main tunnel now in 50 ft. in the gravel will be advanced to 1000 ft. to reach the opposite rim. An air compressor and power drill plant will be installed. George A. Sanborn, La Porte, is manager.

Tehama County

Tom Head—This copper mine, 30 miles west of Red Bluff, is being developed by a Chicago syndicate, with N. E. Payot resident manager. About 2000 ft. of tunnel has been completed. The property is equipped with hoist, air compressor, and sawmill. The ore is chalcopyrite and iron sulphide, and contains small values in gold and silver. It is reported that the owners contemplate the erection of a smeltery upon the completion of the development work.

Colorado

Boulder County

U. S. Refining—The $100,000 plant at Loomis, having a capacity of 30,000 gal. of oil per day, is to be put in operation soon. The oil is transferred by gravity from the Boulder oilfield to the plant and through the refinery in the same way. It is stated that the Freeman process is used by which the paraffin in the crude oil is transformed into oil, every part of the crude oil thus being utilized.

Clear Creek County

Capital—From Georgetown it is reported that Holcomb & Co., leasing on the Aetna vein, have 18 in. of milling ore. Esgrig & Co., lessees, are also said to have a streak of smelting ore.

Cripple Creek District

Mary McKinney—In a winze being sunk to water level, which is about 65 ft., a car of ore has been mined which contained 5 oz. of gold per ton. The August output was 17 cars, chiefly mill ore.

Elkton—As the drainage tunnel is now to be continued, this company has decided not to sink its main shaft as intended; as there are large reserves of ore in sight, it can afford to wait until a dry shaft can be sunk another lift of 100 ft. At present the water is only 60 ft. below the bottom.

Lake County—Leadville

Morning Star—Three miners imprisoned for 60 hours by a cave-in have been rescued alive. Food was supplied through a 4-inch pipe, while rescue work was being done.

Park County

Beaver—The Marion company has submitted plans for a 3½-cu.ft. dredge to handle 50,000 yd. per month, for this placer of 640 acres, near Alma. The operating cost is given at 5c. per yd. and the value of the gravel 50c. per yd. Charles Sumner is manager.

San Juan County

The activity in the La Plata district is so great as to nearly approach a boom. While the May Day and Idaho mines are in litigation and not shipping, still twice as much ore is being shipped now as was sent out a year ago when those two mines were the main producers. Strikes of high-grade ore are reported in the Duke, Bessie G. and Lightner Creek mines, and the Durango smeltery is said to be working at half capacity on these ores.

Tomboy—During August the mill in 26 days crushed 8700 tons of ore, yielding $37,000 in bullion, and $27,500 in concentrates. Expenses were $39,500 and profit $25,000.

Idaho

Coeur d'Alene District

Stewart—The company has leased the old Tiger mill at Burke, from the Federal Mining and Smelting Company. This is the second mill that has been leased from the Federal company. The forces at the mine will be doubled in order to keep these mills running. The two mills have a capacity of 1000 tons.

Bullion—Two carloads of equipment have been sent to this copper mine, which is six miles east of Murray. The entire plant was wiped out a year ago by the forest fires. A recent strike of gray copper is the cause of the renewed activity.

Reindeer—The shaft at this property is down 400 ft. and is to be sunk 200 ft. more before drifting will be commenced. The shaft is being sunk on the vein and has been in lead and copper ore carrying gold and silver for the entire 400 feet.

Michigan

Copper

Oneco—The shaft at this property is sinking below a depth of 850 ft. on its way to open the lode at a depth of about 1400 ft. at which point a good drill core was taken.

Ojibway—Stopes are being opened at the 500-, 650-, 800-, 950- and 1500-ft. levels of No. 1 shaft, and at the 350-, 800-, 1250- and 1500-ft. levels of No. 2 shaft.

Houghton—Sinking has been resumed after a temporary suspension while a crosscut was driven to the lode at the 460-ft. level. The lode where it is opened by the crosscut is about 16 ft. wide and shows an encouraging amount of copper, although the formation is of a rather unsettled character.

Old Colony—No. 9 drillhole sinking vertically to cut the lode exposed by No. 8 hole, and believed to be identical with the one on the St. Louis tract, is nearing the point where it is expected to cut the lode.

Indiana—The shaft is sinking below a depth of about 400 ft. It is expected eventually to open the lode from which a rich drill core was taken about two years ago, at a depth of approximately 1100 feet.

Lake—Sinking has resumed below the eighth level in the new shaft and openings are being extended at all points below the second level. The surface equipment is nearing completion. There are over three miles of underground openings and the property is rapidly being put in condition to enter the producing list.

Mayflower—Two copper-bearing lodes have been cut in hole No. 15, both of which yielded good cores.

Michigan—Tributers are at work on this property, on a royalty basis, and the company is making a small profit.

IRON

Cliffs—A considerable tonnage has been removed from the stockpile during the last few weeks. There is sufficient stocking area at this mine to hold all the ore that can be hoisted for two years.

Montana

BUTTE DISTRICT

Anaconda—At the Pennsylvania mine for the month of August approximately 1050 ft. of drifting, crosscutting and raising were done. At present there are 475 men employed underground and on surface, and between 900 and 950 tons of ore are being hoisted per day. The extension of the airshaft from the 1400- to the 1600-ft. level is being accomplished by raising from the 1600-ft. level; this raise is now up about 75 ft. and should connect with the bottom of the airshaft within six weeks. The tram from the main shaft to the waste dump is being reinforced by the addition of new bents, heavy uprights and timber girders. A crosscut on the 1000-ft. level has cut a vein of high-grade ore carrying considerable copper glance. Due to carefully planned ventilation the mine, which a few years ago was quite hot, is today one of the best ventilated mines in Butte. Mining can be pursued in any part with the greatest efficiency. The Anaconda company has recently placed an order for 13 G. E. electric locomotives to be used in the mines at Butte.

Barnato Gold Mining Company—Articles of incorporation have just been filed in Butte. The capitalization is $500,000, par value, $1 per share. The directors and subscribers are Ralph M. Hodgens and W. P. Thompson.

LINCOLN COUNTY

J. Y. Owenbey and G. F. Hinton, who have been prospecting with a steam drill the placer ground on Libby creek, owned by William Criderman and John H. Town, have struck gold-bearing gravel under a clay bottom 3 ft. thick, which has heretofore been thought to be bedrock. The gravel above averages about 25c. per yd., and that below the clay ran as high as $1.50 per pan from one drill hole.

Snowshoe—For the purpose of hauling concentrates from the mine to the Libby Lumber Company's railroad, a distance of eight miles, three automobile trucks have been ordered, to take the place of teams used heretofore. The first of the trucks has arrived and will be put in service at once.

MADISON COUNTY

Omaha—A test run of 75 tons of ore has just been made at the Shafter mill by W. B. Millard, manager of this mine on the point of Oro Cache hill, and the results may justify the remodeling of the Kearsarge mill for the treatment of the ore. Development work underground will be done first. The ore is feldspar and quartz containing free gold.

Nelson—At the mine in French gulch, leased by Parkison & Stranahan, shaft sinking is going steadily forward. The shaft is in a body of gold-bearing feldspar, streaked with quartz and iron, and ore is being hauled to the Shafter mill for a test run. This property was worked in a small way 20 years ago, but has been idle since.

Winnetka—Work is being pushed on three tunnels on this group of mines, owned by the Ballahala Mines Company, and all are in ore. On the strength of the showing a mill is to be erected soon, and lumber for it is now being turned out at the sawmill near the mine. It is hoped to have the mill in operation by December.

Nevada

COMSTOCK LODE

Mexican—Development work in the ore vein on the 2300, 2400 and 2500 levels continues to disclose a wide deposit of milling- and shipping-grade ore, the production from this work for the last three weeks having averaged about $14,000 per week. Some high-grade ore was opened on the 2300 level that gave several cars assaying $338 per ton, the highest car-assay average yet recovered. Sinking of the new inclined winze below the 2500 level has been held up temporarily on account of repairs being made to the C. & C. shaft pumps. Ore shipments to the smeltery were resumed last week.

Ophir—Work is still suspended on the 2500 level, due to water that came in through old workings recently opened up to the joint Ophir and Mexican winze. Prospecting in the 2400-level vein continues to give low assay returns, but is disclosing a firm quartz formation. The recovery last week was $14,480.

Union Consolidated—The joint winze with the Sierra Nevada is now 2534 feet below the surface, and the quartz and porphyry formation is somewhat softer. An east crosscut is being driven on the 2400 level in the vein.

Crown Point—A railroad car of concentrates has been shipped to the smeltery from the last run of ore at the Yellow Jacket mill.

Best & Belcher—The joint winze with the Gould & Curry and Savage from the Comstock tunnel level is well started, the new machinery being in working order. Foundation timbers are being put in for the station and chute.

Belcher—The old joint incline shaft has been retimbered and reopened for 50 ft. at the 1400 level.

CHURCHILL COUNTY

Nevada-Wonder—The 100-ton mill is operating steadily and the first bullion bars to be made in the district were run recently. Thirty men are employed at the mine. Development work is being conducted steadily at the rate of over 100 ft. per week.

Nevada Hills—The concentrating plant is expected to be in operation soon. It is stated that there is an ample supply of water, and that the minimum capacity of the mill will be 125 tons per day. The ore zone has been developed for 1500 ft. along the trend and to a depth of 565 ft. or to the eighth level.

HUMBOLDT COUNTY

Seven Troughs Coalition—The 50-ton cyanide plant is completed and treatment of ore will be begun at once. The construction of the plant is such that a maximum of 200 tons of ore may be treated daily without increasing the number of vats.

LYON COUNTY

Nevada-Douglas—Operations underground are being conducted through the new double-compartment incline shaft. The concrete bed for the new electric hoist is completed, and the compressor is in operation steadily. The new station pump, the largest in the district, is ready to be lowered to the 800-ft. level.

WHITE PINE COUNTY

Giroux—Both the Alpha and Giroux shafts have been unsealed for several days. The latter has been inspected to the 1000-ft. level and found in good condition. The ground is standing well, and the fire is completely out.

Ely Central—Development work in the form of churn drilling has been resumed after a shutdown of several months. According to a circular sent out by the reorganization committee, the court at Ely decided it was without jurisdiction to appoint a receiver and the representative of the company is now in charge. The officers of the corporation are reported to be working in harmony with the reorganization committee in order to wind up the affairs of the old company, according to law, and to form a new corporation. It

is possible that some arrangement may be entered into with the Ely Consolidated company. The drill is working at a point about 1200 ft. east of the Nevada Consolidated shovel pit.

New Mexico

Socorro County

Providence—The work of converting the old stamp mill at Socorro into a cyanide plant has been completed; the mine has been cleaned out, ready for production. The ore carries silver in a baryta gangue and it is the intention to recover the silver by cyanide solution and to ship the baryta to an Eastern factory.

American Zinc—Work has been resumed in the Linchburg tunnel.

Tribullion—The contract to sink the Contact shaft from the 200- to the 300-ft. level has been given up by the contractors and the work will be continued by the company with day labor. Work is to be resumed on the Nit property and a shaft will be sunk as soon as heavy machinery has been installed.

Juanita—The orebody is becoming wider and larger with development work.

Oregon

Great Northern—The stamp mill and other machinery at this mine in Lane county, near Blue River, were recently destroyed by fire.

Daines—The Golden Gate Mining Company, recently organized, has acquired control of the holdings of this company at Greenhorn, Baker county, and will operate the mine on a larger scale than heretofore.

Homestake—Some good ore has been encountered on this property, in Baker county, and the company is making preparations to do development work. A. E. Dagany, Sumpter, has charge.

Utah

Beaver County

Horn Silver—The company is reported to have closed a contract with the A. S. & R. for the marketing of 2500 tons of low-grade silver-lead ore per month. Shipments will commence at once.

Juab County

Tintic shipments for the week ended Sept. 8 amounted to 120 cars, those for the week previous to 143 cars.

Beck Tunnel—During the last few weeks enough ore has been shipped to exceed operating expenses by about $4000.

Black Jack—The annual report issued Sept. 7 showed receipts of $19,271, including an overdraft Sept. 1 of $4478. A good deal of development was done during the year, chiefly on the 200- and 1000-ft. levels. Some ore was encountered, but not in paying quantities. Three leases in the Star workings, the lower levels of the Black Jack itself, and the iron deposits, were operated, netting the company $3605. The shaft is down 1535 ft. In the Star section a total of 17,005 ft. of work has been done.

Dragon Iron—Work through the company's shaft has been suspended, and prospecting will be continued through the Iron Blossom No. 1 shaft.

Opex—The property has been ordered closed down, and an assessment of ¾c. per share levied to cancel existing debts. Future development will depend on results in the neighboring mines. Ore has not been reached where it was expected.

Uncle Sam—The last quarterly dividend brings the total of dividends paid to $495,000, which is within $5000 of the capitalization. Regular shipments are being made.

Salt Lake County

Bingham Mines—About 50 tons of lead ore are being shipped per day from this company's Dalton & Lark mine. The Commercial is shipping about 125 tons of iron ore carrying a small amount of copper.

Utah Consolidated—Mountain fires during the week ended Sept. 9 destroyed one of the tension stations on the old tram line, dropping the main cable and buckets. The new line to the International was not injured so that shipments have not been interfered with.

South Hecla—The new merger company, which will include this property, is to be capitalized for 100,000 shares, par value $5, and will be organized shortly. The South Hecla territory comprises approximately 550 acres at Alta.

Kennebeck—Leasers on this property in Big Cottonwood are getting the roads in shape to begin shipments from the recent strike. The vein carries 3 ft. of galena, and about 30 sacks per day are being filled.

Columbus Extension—A large number of shares of delinquent stock from assessment No. 6 for 5c. per share, levied July 31, are advertised for sale. A special stockholders' meeting has been called for Oct. 2 to vote on increasing the capitalization from 300,000 to 600,000 shares, and to fix the par value at $1 per share, thereby decreasing the authorized capitalization from $1,500,000 to $600,000.

Tooele County

The reported gold strike in Hickman cañon, nine miles west of Stockton, has not created any new excitement. It is reported that high-grade copper float has been picked up in the cañon.

Cliff—Twenty-three cars of ore were shipped during August, instead of the usual output of a car per day. The shipments were held back by the burning of the company's loading trestle at St. John. The regular output is from 300 to 400 tons per week. Several new faces of ore have been opened, making a total of 12 or 13 places where ore is being mined. Five machines are in use, chiefly on development work.

Buffalo Consolidated—A distribution of $8.75 per 1000 shares of stock has been ordered by the directors to be made Sept. 15. The total amount distributed will be $5500. The claims of this company are under lease and option to the Lion Hill Consolidated, and the above is a partial distribution of assets, not a dividend. There is still due the company about $15,000, the last of a total payment of $25,000 to be received from the Lion Hill for a group of six claims at Ophir.

Washington

Considerable excitement has been caused in the Pilchuck valley, Snohomish county, by the discovery of a large quantity of float rock showing peacock ore, and in some samples free gold.

Gordon—A number of claims have been staked by J. R. Roman, of Waterville, and others, who recently discovered a gold-bearing placer deposit near this place in Douglas county. A number of small rubies were also found in the ore.

Red Mountain—Development work will be started at once on this property in Chelan county, under the direction of Harry Kropfeiffer, Leavenworth.

Wisconsin

Grant County—The Wisconsin Zinc Company has leased this mine, which adjoins the Empire on the north.

Wilkinson—The Vinegar Hill Zinc Company has completed a 100-ton mill at this mine, near Benton.

Lucky Twelve—The company is building a magnetic separator and roaster at New Diggings.

Merry Widow—A 50-ton mill is being erected at this mine, three miles west of Galena.

Philippine Islands

In the Paracale district, the Malaguit dredge recovered 50 oz. gold in the last half of June, but was laid up for repairs in July. The Paracale Gold Dredging Company recently made a shipment of 252 oz. gold. Representatives of an Australian syndicate are testing the values of a large tract of dredging ground along the Paracale river.

Benguet Consolidated—This mine in the Benguet district reports an output of 99.5 oz. gold in July. At the Headwaters mine the mill is completed and a test run has been made under direction of F. L. Cole, who has been appointed consulting engineer.

East Batan Coal—On the island of Batan this company has completed its new bunkers and loading plant. The cost was defrayed by a loan from the Bureau of Navigation, the company agreeing to supply coal at the rate of 5 pesos per ton until the money is repaid.

Canada

British Columbia

Hall Mining and Smelting—The smeltery at Nelson has been destroyed by fire; it had not been operated for some time. The works included two lead stacks, Huntington-Heberlein converters, etc.

Kootenay Gold—A small plant is to be put in to try to save palladium, recently discovered in gold-quartz ore from the company's Granite-Poorman mines. This will be accessory to the company's 20-stamp mill.

Mother Lode Gold—William Watson, of New York, is directing equipment of this Sheep creek gold mine with milling machinery. There was much ore developed last year before the milling plant was ordered.

Corbin Coal—Coal is being mined and shipped despite efforts of local U. M. W. A. officials to induce miners to refrain from working. So far, this is the only mine in southeastern Kootenay at which coal production has been resumed.

Britannia—About 300 men are employed at this company's copper mines on Howe sound, near Vancouver. Ore and concentrates are being shipped to the smeltery at Tacoma.

Ontario—Cobalt

Drummond—Steady shipments of low-grade ore are being made and new ground is now being opened up near the Hargraves line. Good results are being obtained.

Bellellen—Good ore has been opened up below the 100-ft. level of this South Lorrain property.

Townsite—A new vein has been opened upon the 100-ft. level. The company has given a contract to the Northern Customs concentrator to treat 50 tons of low-grade ore per day.

Ontario-Porcupine

Dome—The capital has been increased from $2,500,000 to $3,500,000 by the issue of $1,000,000 additional stock, taken up by present shareholders in the ratio of two new shares to every five held.

Preston-East Dome—The damage to plant and buildings by the fire has been repaired, and the shafts are being pumped out for the resumption of work.

American Goldfields—Shafts are being sunk on two veins and a quantity of ore taken out in the course of development is being sacked.

Rea—Two shafts are now down 200 ft. The second, 160 ft. from the main working, has been opened by a raise from the 200-ft. level. No. 1 shaft will be put down 100 ft. further. Nearly 300 ft. of drifting have been done at the 200-ft. level where the vein is 4 ft. wide and free gold has been encountered at several places. A large quartz vein 60 ft. wide has been discovered on the surface for 250 ft. and found to be a continuation of the main vein.

Pearl Lake—Free gold has been struck, in diamond drilling, at a depth of between 650 and 700 ft. in both the schist and quartz stringers.

West Dome—Three boilers of 150-h.p. capacity and a 20-h.p. hoist have been installed.

Three Nations—A seven-drill compressor and boilers of 200-h.p. capacity have been ordered for the operation of this property, situated about three miles east of Golden City.

Quebec

Black Lake Asbestos Company—This company, at Black Lake, has closed a contract with English buyers for an amount equal to the company's output for the current year. Only half of the mill has been in operation and work on the remaining half will now be pushed.

Mexico

Chihuahua

The output of the Parral camp for the week ended Sept. 8, was about 16,000 tons, of which about 11,000 tons were milled locally. This is an increase of tonnage of about 25 per cent. over preceding weeks and is attributable mainly to the milling ore treated at local plants. Both the Veta Colorado and Alvarado companies are planning to double the capacity of their plants.

La Virgen—The water level has been reached at a depth of 72 m. No more work will be done until after the elections, when a pump will be installed and work resumed on a larger scale.

Resolana—A company has been formed by Texas people to operate this mine at Santa Barbara. Work will not be commenced until after the elections.

Predilecta—A recent excessive flow of water caused the drowning of the large pumps, necessitating cessation of work until new pumps can be installed. The damage will amount to $15,000.

Carmen—Rich silver ore has been struck at this property in the Santa Eulalia camp and shipments are being made. W. J. Mitchell and associates are the lessees.

Fortuna—San Antonio men are operating this property in El Oro camp, west of Terrazas. Hoisting and pumping plants have been ordered and will be installed soon. Norval J. Welsh is the managing engineer.

Esmeralda-Parral—Shipments are now being made to the Mapimi smeltery at the rate of three carloads weekly. Wade Armstrong is the manager.

Durango

A road has been surveyed from Lustre to Rosario. It is expected that the road will be completed within three months and that both passenger and freight automobiles will be used in a regular service upon it.

Mexican Consolidated—At the Soto mine in the Guanacevi district a promising vein of silver ore was struck. The mill is now treating 125 tons of ore per day. S. C. Sears is manager.

Restauradora—This mine and mill have been sold to an English syndicate by Ayton & Co. The price reported was more than $1,000,000. Work will not be started until after the elections.

Mexico

El Oro Mining and Railway Company—During August 31,050 tons of ore milled yielded $202,390; working expenses were $99,840; expenditures on development $27,100; railway profit was $9000, total profit $84,450.

Sonora

In the Klondike district, 50 miles southeast of Magdalena, considerable excitement has been caused by the discovery of bonanza gold ore at a place 10 or 12 miles southwest of the Santa Rosalia mine. At the Patsy mine owned by O. B. Glover, high-grade ore was found at a depth of 150 ft. in a shaft. Other strikes of the same nature are reported from the Maytorena and Juan Cabral claims. There is some placer ground in this vicinity that reverted to the government because the Canadian company that started work on a group of claims failed to pay taxes.

Minas Pedrazzini—The report that bandits robbed the offices at the Chispas mine of this company is denied.

Cerro Gordo—At this mine near Cumpas, the wood-burning reverberatory furnace has been completed and trial runs have been made. O. L. Neer is in charge.

Richfield Copper Company—A smeltery is being built at this mine 18 miles southwest of the Santa Rosalia mine. The company is controlled by Scranton men.

Guerigrito—A cyanide plant is being built at this mine between Cumpas and Nacozari. J. E. Humphries is manager.

Africa

Transvaal

Gold production in the Transvaal in August is reported at 682,406 oz. from the Witwatersrand and 31,001 oz. from the outside districts; a total of 713,407 oz., or 4149 oz. more than in July. For the eight months ended Aug. 31 the total was 4,947,488 oz., or $102,264,577, in 1910, and 5,398,817 oz., or $111,593,547, in 1911; an increase of 451,329 oz. this year. In August there were 68 mills at work, having a total of 10,177 stamps.

Asia

Chosen

Oriental—During July, 240 stamps crushed 28,060 tons, which yielded $91,591 gross and net $19,790. Operating expenses were $70,755, development work, etc., $1046.

The Markets

Coal Trade Review

New York, Sept. 20—The West continues to report a gradual improvement in the coal trade, though mines are not yet as busy as operators had expected. Most of the Western mines will average under 75 per cent. of capacity.

Lake coal trade is doing well. Up to the end of August the coal tonnage passing through the Sault canals was nearly a million tons greater than last year. Shipments are still good.

The seaboard bituminous trade is improving as the season for putting in winter supplies approaches. The anthracite trade is steady and is absorbing a larger tonnage than last year.

Illinois Coal Rates—The Interstate Commerce Commission has issued an order suspending the proposed advances in rates on coal from Illinois mines to Nebraska and Kansas points for three months, until Dec. 13, pending an investigation.

Coal Traffic Notes

Coal and coke tonnage originating on all lines of the Pennsylvania Railroad Company east of Pittsburg and Erie, eight months ended Aug. 31; short tons:

	1910	1911	Changes
Anthracite	7,235,063	7,649,696	I. 414,633
Bituminous	26,793,789	26,875,301	I. 81,512
Coke	9,260,048	6,962,313	D. 2,297,735
Total	43,288,900	41,487,310	D. 1,801,590

The total decrease this year was 4.1 per cent., the loss being entirely in coke.

Coal and coke tonnage of the Chesapeake & Ohio railway for the fiscal year ended June 30, 1911, short tons:

	Coal	Coke	Total
Tidewater	4,055,034	15,711	4,070,745
Eastbound	1,928,842	109,520	2,038,362
Westbound	9,331,270	63,012	9,394,282
Conn. lines	102,210	19,432	121,642
Total	15,417,356	207,675	15,625,031
Total, 1909-10	15,082,237	467,740	15,549,977

This year tidewater tonnage was 25 per cent. of the total; tonnage to points east of mines, 12; to points west, 61; connecting lines, 1 per cent. The total increase shown this year over 1909-10 was 75,054 tons, or 0.5 per cent.

Coal passing through Sault Ste. Marie canals season to Sept. 1, short tons:

	1910	1911	Changes
Anthracite	1,060,259	1,226,515	I. 166,256
Bituminous	7,297,788	8,116,034	I. 818,246
Total	8,358,047	9,342,549	I. 984,502

The August tonnage of soft coal through the canals was the largest ever reported. The total tonnage for the season shows an increase of 11.8 per cent.

Coal receipts at Boston eight months ended Aug. 31, reported by Chamber of Commerce:

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

	1910	1911	Changes
Anthracite	1,145,944	1,292,109	I. 146,165
Bituminous	2,742,655	2,754,234	I. 11,579
Total domestic	3,888,599	4,046,343	I. 157,744
Foreign	199,764	170,666	D. 29,098
Total	4,088,363	4,217,009	I. 128,646

The foreign coal is nearly all from Nova Scotia mines.

Coal shipments of Virginian Railway in July, the first month of the fiscal year, in short tons:

	1910	1911	Changes
Commercial coal	123,644	203,432	I. 79,788
Company coal	9,919	17,435	I. 7,516
Total coal	133,563	220,867	I. 87,304

Coke is not reported separately. Shipments—coastwise and foreign—from Sewall's Point piers were 169,976 tons in July.

New York

Anthracite

Sept. 20—That trade is good is shown by the fact that August shipments were 535,752 tons more than in August of last year, but none of this coal went into the storage yards. Moreover there is little or no free coal at tidewater. The domestic sizes are in steady demand and steam sizes are active, buckwheat and rice being in rather short supply. Coastwise shipments are increasing.

Schedule quotations for domestic sizes are $4.75 for lump, $5 for egg and stove and $5.25 for chestnut; all f.o.b. New York harbor. For steam sizes quotations are: Pea, $3@3.25; buckwheat, $2.30@2.70; No. 2 buckwheat or rice, $1.75@2.15; barley, $1.50@1.70; all according to quality, f.o.b. New York harbor.

Bituminous

The spurt in harbor trade, referred to last week, is about over. Demand continues fair, however, and sales for coastwise shipment are increasing. On the whole the trade is looking up. New England buyers are taking more, and the demand from the shoalwater ports will be coming in soon.

Prices are firm, but not quotably higher. A good steam coal can be had for $2.50@2.60, f.o.b. New York harbor; lower grades sell down to $2.35 and better up to $2.90. Gas coals are $1.15@1.20 for ¾-in., and $1.05@1.10 for run-of-mine, at mines. Slack is still uncertain.

In the coastwise trade vessels are in fair supply, but rates are firm. From New York going rates are 55@60c. to Boston or Portland, with 10 or 15c. more to the shoalwater and towage ports; 35@40c. to Providence and Fall River; 25c. to the Sound. From Philadelphia to Boston or Portland, 70@80c. is quoted. From Norfolk or Newport News to Boston, 65@70c. is asked.

Birmingham

Sept. 18—Coal operations in Alabama are picking up. Announcement of deals is made whereby Pennsylvania people get possession of some coal lands in Alabama; in each instance it is stated that there will be development. One of the larger coal-producing companies in Alabama is reported to be behind in deliveries. There is need for labor at some of the collieries.

Coke production and demand are both improving. The byproduct coke ovens of the Tennessee company near Ensley, are nearing completion.

Chicago

Sept. 18—The coal market in general is in good condition; sales are gradually increasing for steam purposes and while many retailers and large consumers are neglecting to put in their stocks of domestic coals there is every prospect that their orders will be numerous after the first cool weather. Meanwhile the thoughtful ones are buying steadily and their number is increasing. The car situation naturally causes some anxiety in view of the rush that is sure to occur with the active demand, but the experience of the last few years shows that the trouble seldom amounts to so much as is anticipated. Western mines are in good condition and capable of responding quickly to the demand, though they, of course, would prefer to have trade more evenly distributed.

Car prices remain practically unchanged—Illinois and Indiana bring $1.85@2.45 for lump, $1.75@1.85 for run-of-mine and $1.25@1.45 for screenings. The last named size has been subject to some variation in the week but has not recovered its popularity of a few months ago, with the result that prices remain lower. Of eastern coals Hocking continues the most even; West Virginia smokeless has something more of lump on hand, but not enough to supply the demand, and smokeless run-of-mine is

plentiful. Anthracite sales are lagging, but are better than they were a week ago, especially in the country.

Cleveland

Sept. 18—Trade is improving slowly, both in steam and domestic coal. The railroad movement is rather slower, and cars are not too plentiful.

Prices for Middle District coal, f.o.b. Cleveland, are quoted at $2.15 for 1¼-in., $1.90 for ¾-in. and $1.80 for run-of-mine. Slack is in oversupply and prices are variable. Pocahontas brings $2.25@2.35 for lump; $2.35@2.45 for run-of-mine.

Indianapolis

Sept. 18—For the first August for 40 years the Indiana coal operators failed to experience a rush in coal mining. Heretofore orders enough came in during August to put every mine in operation at full capacity, but the record was broken this year. The operators say there has been some improvement, but the failure of the usual rush has occasioned some uneasiness. The steam trade is dull, but why domestic trade is lagging is not readily explained. While the outlook for steam coal is uncertain, operators say a demand for domestic coal will not be delayed much longer. According to report not more than one-third of the usual winter supply has been stored.

Pittsburg

Sept. 19—Prices for domestic coal are not thoroughly settled yet, there being considerable irregularity. For manufacturing consumption there is no material change in either prices or tonnage. Mines in the district are operating at an average of about 75 per cent. of capacity. Shipments in the Lake trade keep up well and there may be an improvement before the close of the season, if the congestion at upper Lake ports is reduced. We continue to quote: Nut, $1.10@1.15; mine-run, $1.15; ¾-in., $1.25; 1¼-in., $1.35; slack, 60@75c. per ton at mine, there being occasional deviations from these prices, particularly on slack.

Connellsville Coke—Sales of about 125 cars of prompt furnace coke have been made in the past week or 10 days, in half a dozen lots, at $1.50 at ovens, which is the regular market, while a month's regular supply might bring $1.55. There have been no negotiations on contract, the few consumers not covered by contracts for the balance of the year having concluded to take their chances in the prompt market, so that the market on contract-furnace coke has become nominal. Perry furnace, at Erie, will blow in next Monday, a Shenango furnace will go in this week and Cherry Valley, at Leetonia, will likely blow in within a fortnight, these all being merchant stacks tributary to the Connellsville region. We quote: Prompt furnace, $1.50@1.55; contracts over last three months, $1.70@1.75; prompt foundry, $1.85@2; contract foundry, $2@2.25 at ovens.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ended Sept. 9, at 329,759 tons, a decrease of 17,000 tons, and shipments at 4474 cars to Pittsburg, 5003 cars to points West and 981 cars to points East, a total of 10,458 cars.

St. Louis

Sept. 18—Never before in the history of the coal trade here has there been such a dull September. August was quite brisk and gave promise of better things, but since Sept. 1 the market has been getting worse almost daily. Prices on all domestic sizes have remained about the same, though screenings have gotten down as low as 25c. per ton, f.o.b. mine. The weather is evidently responsible for a large part of the dullness, as the thermometer has been over 90 deg. nearly every day. Dealers have all the coal that they can put away in storage, but report that the consumers are not storing coal anything like as early this year as heretofore.

The industrial situation is slower now than at any time this season. This, with overproduction on screenings, has made steam coal sell at prices that are the lowest recorded in the last three or four years. While the bulk of the coal that is coming to this market locally is from Standard district, yet the reason for the poor prices of Standard coal is the competition of the Carterville district, where operators, being unable to place their regular tonnage in Chicago and the north, are concentrating their efforts upon the St. Louis market.

The tonnage report for the first 15 days of September shows a fair tonnage. The comparative receipts for the last four years are: 1908, 298,568; 1909, 298,522; 1910, 432,105; 1911, 310,142 tons.

Anthracite—The market has been a little slow locally for the past few days, though chestnut has been moving very well to the country trade. There is no demurrage coal on hand.

West Virginia smokeless has been moving well and dealers report that the tonnage will be much larger this year than ever before.

FOREIGN·COAL·TRADE

German Coal Production—Output of coal in the German Empire, seven months ended July 31, metric tons:

	1910	1911	Changes
Coal	86,360,970	92,278,434	I. 5,917,464
Brown coal	38,027,891	39,813,351	I. 1,785,460
Total mined	124,388,861	132,091,785	I. 7,702,924
Coke made	13,388,070	14,580,632	I. 1,192,562
Briquets made	10,826,772	12,099,739	I. 1,272,967

Of the briquets reported this year 9,264,206 tons were made from brown coal or lignite.

British Coal Trade—Coal exports of Great Britain, with coal sent abroad for use of steamships in foreign trade, eight months ended Aug. 31, long tons:

	1910	1911	Changes
Coal	40,813,771	41,831,040	I. 1,017,269
Coke	570,969	617,294	I. 46,325
Briquets	1,037,742	1,117,783	I. 80,041
Total exports	42,422,482	43,566,117	I. 1,143,635
Steamer coal	12,739,619	12,665,440	D. 74,179
Total	56,162,101	56,231,557	I. 1,069,456

Imports of coal were only 22,791 tons in 1910, and 16,147 this year.

German Coal Trade—Exports and imports of fuel in Germany, seven months ended July 31, metric tons:

	Exports	Imports	Excess
Coal	15,225,320	6,024,955	Exp. 9,200,365
Brown coal	32,209	4,101,264	Imp. 4,069,055
Coke	2,524,378	350,781	Exp. 2,173,597
Briquets	1,350,900	125,979	Exp. 1,224,921
Total	19,132,807	10,602,979	Exp. 8,529,828
Total, 1910	16,221,266	10,737,755	Exp. 5,483,511

Exports this year included 7716 tons of coke to the United States.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of coal for export on Sept. 1 as follows: Best Welsh steam, $4.38; seconds, $4.08; thirds, $3.78; dry coals, $4.08; best Monmouthshire, $3.72; seconds, $3.54; best Cardiff steam smalls, $2.28; seconds, $1.86. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, Sept. 20—The iron and steel markets continue to show a good amount of new business, done at the lower prices which are now generally accepted. Reports still speak of "cut" or "shaded" prices, but these are not correct terms, as there is practically an open market, and there is no longer any attempt to maintain quotations at any standard point.

It was reported that a meeting of steel men would be held in New York this week to consider the situation. It is denied, however, that any meeting has been called, and probably no formal one will be held. It happens, nevertheless, that a number of prominent manufacturers are in the city, and doubtless some consultation is going on. There is rather a disposition at present to avoid formal meetings.

In finished materials structural steel is again the leader, and some large orders have been placed, with a number of small ones. Plates have also been active, as well as sheets and bars. Wire business has been large. Buyers continue to place only moderate orders for the most part, not seeing any need for contracting far ahead under present conditions.

Pig iron has been fairly active. In seaboard territory a fair tonnage of foundry iron has been taken, with some basic. In the Central West there seems to be a better demand for basic iron. Inquiries

are gradually extending into 1912, but most buyers do not go beyond the year.

Export trade is reported good. At present more rails are being taken for export than for home use.

Panama Scrap—On account of some protests filed, the Panama Canal Commission has rejected all the bids for the old French scrap, and will probably advertise for new bids. The highest offers were made by the Chicago House Wrecking Company, which bid $215,000 for the minimum quantity of 45,000 tons, and $700,000 for the maximum, 125,000 tons.

Baltimore

Sept. 19—Exports for the week included 202,160 lb. pipe to Liverpool. Imports included 1596 tons ferromanganese and 530 tons spiegeleisen from Great Britain; 4594 tons iron pyrites from Huelva, Spain; 9940 tons iron ore from Cuba.

Birmingham

Sept. 18—The pig-iron market in the South has been a little quiet again. The quotations are around $10.50, No. 2 foundry, though the general price is 25c. under that. There is still some inquiry for iron for delivery during the first quarter of 1912. There is some iron moving out and the recent inventory showed a reduction in the stocks on hand.

A complaint has been made to the Interstate Commerce Commission by the Board of Trade of New Orleans that the freight charges by the railroads out of the Birmingham district on pig iron to that city are too high, as compared to rates made to 12 other cities of same and more distance. The railroads assert that there is no discrimination against New Orleans.

The scrap-iron market is quiet. The foundries and machine shops report no improvement worthy of mention lately.

Chicago

Sept. 18—No change of importance yet marks the condition of the iron trade. There is a constant, fair demand for Northern and Southern pig iron in small lots bought often, and the total of this business seems to be increasing slowly as foundries settle into their autumn conditions. Inquiries are numerous for first-half tonnage; few sales are made for delivery later than the end of the first quarter.

Southern No. 2 is quoted nominally at $10.50, Birmingham, or $14.85, Chicago; practically it is obtainable at 25@50c. less on lots at all large. Northern No. 2 iron holds to $14.50 and has a steady demand that yet is not large enough to dispose satisfactorily of the product of the furnaces, so that there is considerable pressure to sell. Melters seem to be of the opinion that there is overproduction still and will not buy heavily.

In the market for iron and steel products conditions are more satisfactory to the sellers; there is a heavy demand for structural material and for most manufactured shapes, but railroad buying is not so active. The demand for coke is improving, indicating greater activity on the part of the pig-iron users.

Cleveland

Sept. 18—Nothing is doing in the way of iron-ore sales. Apparently some furnaces will go into the winter season with light stocks.

Pig Iron—More inquiries are out for fourth and first quarters. Buyers, however, are not disposed to pay the advance on 1912 deliveries which most sellers ask. No change in prices.

Finished Material—Structural-steel orders continue to come, and prices are generally held. In other lines shading continues to go on. Both steel and iron bars are especially weak. Reports are current that as low as 1.15c. Pittsburg base, has been done on steel bars. Sheets are also weak, and some low prices have been made on plates.

Philadelphia

Sept. 20—Two or three influences are responsible for the dullness in pig iron. There are quite a number of inquiries floating around, but the week's transactions show very moderate sales. Only immediate needs are being provided for. The purchases made cover all kinds of crude iron. Founders are disposed to make purchases where slight concessions are offered. The diminution in stocks which is going on is responsible for a little better feeling. Stove makers have declined to accept terms mentioned by some makers, but are still in the market. Inquiries from New England sources for the first quarter next year are the most promising feature of the market at present. In a general way the tone of the market is better than two weeks ago, and a good deal depends on the outcome of negotiations in hand. Quotations are around $15 for No. 2 X foundry, with the better grades of gray forge at $14.50; basic is $14.75 with offers at $14.50. The demand for basic is at a very low ebb.

Steel Billets—Billets have not gained the activity that was thought probable a week or two ago. Quotations continue at $23.40 for open-hearth billets.

Bars—The store demand for bars, both city and country, shows a decided improvement. Refined iron is quoted at 1.25@1.30c., tidewater.

Sheets—Sheets have lost a little in steadiness of prices. The latest quotations show that manufacturers are a little more anxious.

Pipes and Tubes—The tube market is dull apparently, though the consumption of material shows some improvement.

Plates—The demand for plates is fair, but not up to expectations. It is believed there has been a shading of prices in sympathy with western markets. Car builders are pretty well supplied and are not in the market at present. Shipyard work is coming along steadily and is helping out. The smaller construction requirements are aggregating a round volume of business.

Scrap—The scrap market has been active for a week in machinery cast, No. 1 yard scrap and No. 1 steel scrap. There has been no business to speak of in No. 1 wrought railroad.

Pittsburg

Sept. 19—The tonnage of finished steel being bought or specified for is practically unchanged, nor has there been any material change for several weeks. On the whole the tendency has been slightly downward, and this is noticed somewhat more by the independents than by the Steel Corporation, which has been pursuing a very aggressive sales policy.

Under stress of open competition, prices of steel products have continued to yield a trifle now and then. Steel bars have occasionally been done at 1.15c., although 1.20c. is the general quoting market. Plates are not infrequently done at 1.25c., while 1.20c. is rumored but not confirmed. Structural continues very firm. The fall jobbing trade in wire has not opened up as well as expected from the tonnage standpoint, but the mills seem to be standing firm on the reduction of $1 a ton made about three weeks ago, putting nails at $1.65. Shading in merchant pipe has increased, several cases having occurred in which an extra 5 per cent. has been given, although in general the shading is confined to 2½ per cent. The National Tube Company has adhered to its old prices, and one or two independents have done likewise. A new card is expected to be issued by the National shortly.

The American Bridge Company has taken the buildings for the new open-hearth steel plant of the Youngstown Sheet and Tube Company, involving about 6000 tons of fabricated steel.

The steel industry as a whole seems to be running at about 75 per cent. of full capacity, the Steel Corporation averaging a trifle above this and the independents a trifle below.

Pig Iron—A Valley furnace interest has sold 1000 tons of basic iron for prompt shipment to a Pittsburg district consumer at $13.50, delivered, equal to $12.60, Valley furnace, or 40c. below the figure of $13, Valley, which lately has been quotable as the nominal market. The sale was made in the ordinary course of business and furnishes a definite market basis which has lately been lacking. Foundry iron continues to move in

moderate-sized lots for early delivery, and at unchanged prices. Bessemer remains very quiet. We quote: Bessemer, $15; basic, $12.60@13; No. 2 foundry, $13.50; malleable, $13.25@13.50; gray forge, $13, all at Valley furnaces, 90c. higher delivered Pittsburg, except that foundry iron for Pittsburg delivery can sometimes be had at $14.25, delivered, owing to the giving away of freight advantages by scattered furnaces.

Ferromanganese—The market is quiet, with prompt material available at $36.50@36.75, and forward at $37, Baltimore.

Steel—Sales of small lots of steel at concessions from the open quotations continue. No large lots are being sold. We quote prices $1 a ton lower on open-hearth billets and sheet bars, but would note that even the new quotations could possibly be shaded: Bessemer billets, $21; sheet bars, $22; open-hearth billets, $20; sheet bars, $21, f.o.b. maker's mill, Pittsburg or Youngstown. Wire rods are $27, Pittsburg, but no tonnage of consequence is being sold.

Sheets—Rumors of cuts on black sheets below 1.90c. appear to have a substantial foundation, but the extreme of the cutting cannot be ascertained, and may not amount to $1 a ton. The sheet mills which do not make their steel are believed to be losing money at present prices, and it is not expected that they can keep up the pace long. The low point on black sheets in all history was 1.85c., made for a time in 1898. Since then tonnage wages have declined slightly, but the cost of sheet bars has increased, and general mill-labor cost has probably increased. We quote: Black sheets, 28 gage, 1.90@1.95c.; galvanized, 2.90@2.95c.; blue annealed, 10 gage, 1.40@1.45c.; painted corrugated, $1.35; galvanized, $2.50 per square.

St. Louis

Sept. 18—The volume of business in pig iron seems to be a little larger than for some weeks and the market a trifle firmer. A number of inquiries are being received for next year's shipment, though very little business is being done for delivery after the first quarter. Producers figure that iron for next year's delivery is worth an advance, while consumers are reluctant to speculate on an advanced price. All of the iron that is moving is changing hands at $10.25@10.50, Birmingham, or $14@14.25, St. Louis.

Iron Ore Trade

Deliveries of iron ore to Lake Erie ports in August were 4,368,210 tons, or 78.7 per cent. of the total shipments, which were 5,548,311 tons. The larger deliveries were 1,232,993 tons to Conneaut; 1,065,421 to Ashtabula; 702,285 to Cleveland; 555,593 to Lorain; 473,525 to Buffalo.

Eastern Iron Ore Rates—B. Nicoll & Co., of Perth Amboy, N. J., have filed a complaint with the Interstate Commerce Commission, charging that the railroad rates on iron ore to furnaces from Salisbury, Conn., Fort Montgomery, N. Y., and other eastern points are unreasonably high, and asking that reductions be ordered.

FOREIGN IRON TRADE

British Foreign Trade—Foreign trade of Great Britain for the seven months ended July 31, as valued by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	£25,373,018	£6,501,659	Ex. £18,871,359
Machinery	17,952,018	3,575,125	Ex. 14,376,893
Cutlery and hardware	5,781,039	3,250,919	Ex. 2,530,120
New ships	3,220,582	.....	Ex. 3,220,582
Total	£52,326,657	£13,327,703	Ex. £38,998,054
Total, 1910	52,032,854	10,859,937	Ex. 41,172,917

Increase in exports, £293,803, or 0.7 per cent. The quantities of iron and steel were, in long tons:

	1910	1911	Changes
Exports	2,695,207	2,585,894	D. 109,373
Imports	745,337	1,026,750	I. 281,413

The increase in imports was chiefly in pig iron, billets, tinplate bars and other half-finished material.

Belgian Iron Trade—Exports and imports of iron and steel in Belgium, six months ended June 30, metric tons:

	Exports	Imports	Excess
Pig, scrap, etc.	85,458	376,911	Imp. 291,453
Finished mater'l	630,024	134,441	Exp. 495,583
Total	715,482	511,352	Exp. 204,130
Total, 1910	739,251	491,656	Exp. 247,595

Belgium imports a considerable quantity of pig iron, which is worked up into finished forms in its mills.

United States Foreign Trade

Iron and Steel—Exports and imports of iron and steel and of machinery in the United States for the seven months ended July 31, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1910	1911	Changes
Exports	$112,519,587	$143,917,270	I. $31,397,683
Imports	24,285,898	17,944,044	D. 6,341,854
Excess, exp.	$88,233,689	$125,973,226	I. $37,739,537

Increase in exports, 27.3 per cent.; decrease in imports, 26.1 per cent. The leading items of iron and steel were, in long tons.

	Exports 1910	Exports 1911	Imports 1910	Imports 1911
Pig iron	59,213	76,577	139,918	97,552
Scrap	12,949	51,438	60,389	12,572
Billets, blooms, etc.	7,657	149,419	27,595	17,395
Bars	69,728	82,371	24,934	16,496
Rails	218,518	269,853	.....	.....
Sheets and plates	153,022	190,829	4,073	1,411
Structural steel	89,042	125,665	.....	.....
Wire-rods	12,626	9,866	12,598	10,002
Wire	97,034	120,995	.....	.....
Nails and spikes	34,783	43,079	.....	.....
Tinplates	7,056	30,291	47,010	12,369
Pipe and fittings	88,560	111,798	.....	.....

Imports of wire not reported in quantities; values were $898,432 in 1910, and $820,002 in 1911. Imports of rails and structural steel not reported separately. Exports of mining machinery were valued at $3,597,177 in 1910, and $4,064,615 this year.

METAL MARKETS

New York, Sept. 20.—The metal markets in general are still inclined to be quiet. Prices have generally been weaker, when any changes are recorded, except in a few cases.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Aug. 1911	$ 480,799	$ 4,105,331	Imp. $ 3,624,532
" 1910	3,150,423	12,818,606	Exp. 9,668,183
Year 1911	15,910,449	40,473,010	Imp. 24,562,561
" 1910	53,495,605	42,489,786	Exp. 11,005,819
Silver:			
Aug. 1911	4,869,359	3,653,329	Exp. 1,216,030
" 1910	4,755,708	4,119,362	Exp. 636,346
Year 1911	44,587,570	29,534,724	Exp. 15,052,846
" 1910	36,934,397	29,815,770	Exp. 7,118,627

Exports from the port of New York, week ended Sept. 16: Gold, $50,200, to the West Indies; silver, $820,680, chiefly to London. Imports: Gold, $84,521; silver, $160,053, both principally from Mexico and South America.

Gold—The price of gold on the open market in London remained at the normal level, 77s. 9d. per oz. for bars and 76s. 4½d. per oz. for American coin. The Bank of England took most of the gold arriving.

Platinum—The market is rather quiet, but prices are firmly held. Dealers ask $45 per oz. for refined platinum and $47.50 per oz. for hard metal, 10 per cent. iridium. The foreign markets continue strong.

Iridium—Supplies are rather scarce and the price has advanced to $65 per oz. for pure metal.

Palladium—The price has advanced to $48 per oz. recently, owing to a large and unexpected demand from a German house with American connections.

Silver—The price of silver has remained the past week within narrow limits, fluctuating between 24 3/16 and 24¼d. in London; it is likely to so continue. The news about the monsoon in India is somewhat more reassuring, but a bumper harvest is not expected.

SILVER AND STERLING EXCHANGE

Sept.	14	15	16	18	19	20
New York	52⅜	52⅛	52⅜	52⅜	52⅜	52⅛
London	24 3/16	24⅛	24 3/16	24 3/16	24 3/16	24⅛
Sterling Ex.	4.8605	4.8615	4.8605	4.8610	4.8620	4.8635

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, from Jan. 1 to Sept. 7, reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India	£4,342,000	£5,404,000	I. £1,062,000
China	1,113,500	949,700	D. 163,800
Total	£5,455,500	£6,353,700	I. £898,200

India Council bills in London brought an average of 16.04d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

Sept.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
14	12⅜ @12⅝	12.20 @12.25	39¾	4.47½ @4.50	4.32½ @4.37½	5.85 @5.90	5.70 @5.75
15	12⅜ @12⅝	12.20 @12.25	40¼	4.47½ @4.50	4.32½ @4.37½	5.85 @5.90	5.70 @5.75
16	12⅜ @12⅝	12.20 @12.25	40¾	4.47½ @4.50	4.32½ @4.37½	5.85 @5.90	5.70 @5.75
18	12⅜ @12⅝	12.15 @12.20	39¾	4.45 @4.50	4.32½ @4.37½	5.85 @5.87½	5.70 @5.72½
19	12⅜ @12⅝	12.15 @12.20	38¾	4.45 @4.50	4.32½ @4.37½	5.85 @5.87½	5.70 @5.72½
20	12⅜ @12⅝	12.15 @12.20	39	4.45 @4.50	4.32½ @4.37½	5.85 @5.87½	5.70 @5.72½

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Sept.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
14	55½	55⅞	59¼	180½	177¾	14¼	27¾
15	55¼	56	59¼	185¼	179¾	14¾	27¾
16	.....	.....	.....	.....	.....	.....	.....
18	55½	56¼	59½	180¼	177½	14¾	27¾
19	55⅛	55⅛	59	176	173	14⅞	27⅞
20	54⅞	55⅝	59	176¾	173¾	15⅛	27⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.40c. ± £1 = ± 0.21¾c.

Copper—The continued decline in the stock markets has helped to bring about rather a pessimistic feeling in the metal market, and this has been helped by political conditions abroad. While the Morocco question appears to be in the way of peaceable settlement, the labor strikes are evidences of unrest which are not encouraging. These conditions in Europe have had a depressing effect upon the foreign market, which is beginning to make itself felt in this country in a more pronounced manner than has been the case hitherto. Fear is expressed that reduced activity abroad will mean smaller exports, which latter have been the bulwark of the market in recent months. There has been more competitive selling, with the result that prices close lower at 12⅜@12⅝c. for Lake copper, and 12.15@12.20c. for electrolytic copper in cakes, wirebars, and ingots. Casting copper is quoted nominally at 12@12⅛ cents.

The standard market has been feverish and rather weak throughout the week, and closes uncertain at £54 17s. 6d. for spot, and £55 12s. 6d. for three months.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 13¾c. base, carload lots at mill.

Visible stocks of copper in Europe on Sept. 15 are reported as follows: In England, 52,580 long tons; France, 5790; afloat from Chile, 2400; afloat from Australia, 7400; in Rotterdam, 7400; in Hamburg, 10,800; total, 86,370 tons, an increase of 1000 tons over the Sept. 1 report.

Tin—The London market during the past week was very puzzling to those interested in the metal, remaining fairly steady during almost all of the week. Quotations on Friday last jumped almost £5 per ton, to lose this advance just as quickly on Monday. The decline continued on Tuesday to the extent of over £4. It is impossible to account for these gyrations and the motives of the Syndicate which have caused them. The market closes flat at £176 15s. for spot, and £173 7s. 6d. for three months.

Consumers in this market were buyers during the advance of last week, but were scared off by this week's decline. At the close September tin can be bought at about 39 cents.

Lead—The market is a shade easier at 4.45@4.50, New York, and 4.32½@4.37½, St. Louis.

The shortage of lead in London has become extremely acute, and it advanced from day to day, reaching at the close £15 2s. 6d. for Spanish lead, and £15 5s. for English.

Spelter—It is reported that smelters have large stocks of ore, against which they would like to place spelter for future delivery at prices considerably lower than current quotations. On the other hand, consumers are unwilling to anticipate their requirements and are placing their orders on a hand-to-mouth basis. Spot spelter appears still to be rather scarce, and premiums can be realized in a small way. The close is steady at 5.70@5.72½, St. Louis, and 5.85@5.87½, New York.

The London market is somewhat firmer and closes at £27 17s. 6d. for good ordinaries, and £28 2s. 6d. for specials.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Zinc dust is quoted at 7½@7¾c. per lb., New York.

Other Metals

Aluminum—Business is quiet and sales have been light. Prices have given way again under the pressure of free offerings of foreign metal. We quote 19@19½c. per lb. for No. 1 ingots in large lots, New York.

Antimony—There is nothing new in the market and business continues to be very much of a retail order. Quotations are now given at 8.25@8.37½c. for Cookson's; 7.75@8c. per lb. for Hallett's; 7.20@7.40c. for Hungarian, Chinese and other outside brands.

Quicksilver—Business is rather quiet. The New York quotation is again off slightly, to $46.50 per flask of 75 lb., with the usual advances for small lots. San Francisco, $46 for domestic orders and $43.50 for export. The London price is £8 12s. 6d. per flask, with £8 10s. quoted from second hands.

German Metal Trade

Imports and exports of metals other than iron and steel in the German Empire, six months ended June 30, were, in metric tons:

	Imports	Exports	Excess	
Copper.....	98,826	40,546	Imp.	58,280
Copper, 1910....	91,022	38,478	Imp.	52,544
Tin.....	6,779	5,032	Imp.	1,747
Tin, 1910.....	6,909	5,027	Imp.	1,882
Lead.....	43,287	21,556	Imp.	21,731
Lead, 1910.....	30,688	20,851	Imp.	9,837
Zinc.....	25,580	63,583	Exp.	38,003
Zinc, 1910.....	18,994	53,746	Exp.	34,752
Nickel.....	1,673	1,083	Imp.	1,590
Nickel, 1910....	2,331	760	Imp.	1,571
Aluminum.....	4,396	1,469	Imp.	2,927
Aluminum, '10.	3,913	1,047	Imp.	2,866
Minor metals....	886	6,708	Exp.	5,822
Minor, 1910....	813	6,009	Exp.	5,196

The figures include alloys and manufactures of the different metals. The imports and exports of ores for the half-year were, in metric tons:

Ores:	Imports	Exports	Excess	
Gold ore.....	104	.....	Imp.	104
Gold ore, 1910..	41	.....	Imp.	41
Silver ore.....	1,466	.....	Imp.	1,466
Silver ore, '10..	784	.....	Imp.	784
Copper ore.....	9,805	11,118	Exp.	1,313
Copper ore, '10.	9,471	17,216	Exp.	7,745
Tin ore.....	8,608	45	Imp.	8,563
Tin ore, 1910...	8,220	70	Imp.	8,150
Lead ore.....	58,427	1,851	Imp.	56,576
Lead ore, 1910 .	50,056	704	Imp.	49,352
Zinc ore.....	121,076	26,252	Imp.	94,824
Zinc ore, 1910..	113,902	23,887	Imp.	90,015
Nickel ore.....	6,502	.....	Imp.	6,502
Nickel ore, '10.	3,253	.....	Imp.	3,253
Miscellaneous...	3,740	444	Imp.	3,296
Miscellan's, '10	3.034	352	Imp.	2,682
Chrome ore... ..	4,301	546	Imp.	3,755
Chrome ore, '10	15,218	166	Imp.	15,052
Pyrites.....	376,655	4,243	Imp.	372,412
Pyrites, 1910...	356,034	5,395	Imp.	350,639

Miscellaneous includes ores of tungsten, molybdenum and other rare metals. Imports of slag and slag products were 352,900 tons in 1910, and 342,222 in 1911; exports, 33,270 tons in 1910, and 44,558 tons this year.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 16—The high price of zinc sulphide ore was $48, on a base price of $41@45 per ton of 60 per cent. zinc. Zinc silicate sold on a base of $23@25 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $41.76. The high price for lead ore was $60 per ton, practically all this mineral selling at this price. The average price, all grades, was $59.94 per ton.

The market for zinc ore continued strong up to the week-end, when buyers who had been active purchasers lowered

their offerings $2 per ton. Despite the apparent strength of spelter the market for ore tonight looks like $44 for high base next week. Several smelters are still out of the market, with rumors from the gas country tonight that strike matters, believed to have been settled, threaten a renewed outbreak.

SHIPMENTS, WEEK ENDED SEPT. 16

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,993,700	.....	1,254,820	$123,607
Joplin	1,873,930	.....	232,650	48,200
Duenweg	789,650	59,800	10,070	18,174
Alba-Neck	560,220	.....	.....	12,885
Granby	83,330	806,170	26,170	11,770
Jackson	257,130	....	188,140	11,558
Galena	252,500	.....	122,900	9,242
Oronogo	318,280	.....	.....	6,739
Spurgeon	168,590	141,640	26,000	6,600
Aurora	99,990	.....	.....	2,200
Cave Springs	69,350	.....	.....	1,600
Carl Junction	27,580	.....	.....	662
Totals	8,494,250	1,007,610	1,860,750	$254,237
37 weeks	353,581,000	25,536,370	63,361,520	$9,241,346

Blende val., the week, $186,065; 37 weeks, $7,031,802
Calamine, the week, 12,387; 37 weeks, 405,185
Lead value, the week, 55,785; 37 weeks, $1,804,359

MONTHLY AVERAGE PRICES

Month	Zinc Ore: Base Price		Zinc Ore: All Ores		Lead Ore: All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.57
April	41.00	38.88	39.33	37.47	49.72	56.37
May	40.19	38.25	37.51	36.79	48.16	55.21
June	40.20	40.50	37.83	38.18	48.80	56.49
July	39.63	40.75	36.80	38.36	48.59	58.81
August	40.13	42.50	37.32	41.28	49.75	60.74
September	43.45	.....	39.96	.....	54.73	.....
October	43.31	.....	40.50	.....	53.18	.....
November	47.20	.....	43.20	.....	54.80	.....
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Sept. 16—The base price paid this week for 60 per cent. zinc ore was $44. The base price paid for 80 per cent. lead ore was $56@57 per ton.

SHIPMENTS, WEEK ENDED SEPT. 16

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	966,620	.....	457,830
Galena	811,500	.....	.....
Mineral Point	644,050	.....	.....
Benton	340,500	.....	.....
Highland	322,700	.....	.....
Hazel Green	240,000	.....	.....
Harker	161,710	169,790	.....
Monfort	60,000	.....	.....
Cuba City	54,000	.....	255,100
Linden	.....	57,400	60,000
Total	3,601,080	227,190	772,930
Year to date	108,769,729	6,243,885	22,546,940

Shipped during week to separating plants, 2,864,920 lb. zinc ore.

CHEMICALS

New York, Sept. 20—Complaints are still made of a dull market, but there seems to be considerable business forward.

Copper Sulphate—Business is on a fair scale. Prices are unchanged at $4.50 per 100 lb. for carload lots and $4.75 per 100 lb. for smaller parcels.

Arsenic—There is still a good demand, and supplies are not large, though better than they have been. Quotations remain at $2 per 100 lb. for spot lots, and $1.87½ per 100 lb. for futures.

Nitrate of Soda—Business is steady. Quotations are unchanged at 2.20c. per lb. for spot and 2.22½c. per lb. for future.

Sulphur—Messrs. Parsons and Petit advise us of the arrival at New York, Sept. 16, of 1000 tons of crude brimestone, imported by them from Sicily.

Petroleum

The number of producing oil wells completed in August is reported by the *Oil City Derrick* as follows: Pennsylvania, West Virginia and eastern Ohio, 440; Lima, Ohio and Indiana, 57; Kentucky, 10; Illinois, 146; Kansas-Oklahoma, 287; total, 940 wells. On August 31 there were 1186 wells in process of drilling.

MINING·STOCKS $

New York, Sept. 20—The general stock markets have again been dull and inclined to weakness. It is not that liquidation continues, for that is about over; but there seems little disposition to buy, even at the lower levels. The industrials held their own better than other stocks. Steel Common sold around 65, and Amalgamated Copper at 54@55, on small sales.

The Curb market was irregular, with only a moderate business. Copper stocks were not in much demand, and were generally inclined to go off fractionally. Cobalt stocks were weak, and other mining shares were not active.

One sale of Homestake was reported, 100 shares at $83 per share.

Boston, Sept. 19—Copper shares maintain a steady to firm tone, notwithstanding the weakness of the general market. The mining-share market lacks buying power, yet on the other hand, forced liquidation is so complete that offerings are light. While Calumet & Hecla has been weak the subsidiary stocks show a disposition to improve. Calumet stock broke $20 to $390; the first time that it has gone below $400 since 1897. The price touched $1000 in 1907.

Arizona Commercial has done better marketwise, advancing from a low at 25c. to $1.75, although it did not retain all of this advance. The 6 per cent. convertible bonds are quoted around 45 per cent. A protective committee for the bonds has been organized and has met with good success.

North Butte rose $1.25 to $24.25 and there appears to be accumulation of this stock. The company has declared the usual quarterly dividend of 30c. per share, making a total of $25.45 paid per share since organization. Declaration of a quarterly dividend of 5 per cent. and 2½ per cent. extra on Nipissing shares had no effect on the stock.

Curb trading has been light, though

COPPER PRODUCTION REPORTS
Copper contents of blister copper, in pounds

Company	June	July	August
Alaska shipments	1,773,300	.....	.....
Anaconda	21,850,000	21,900,000	22,500,000
Arizona, Ltd	2,700,000	2,750,000	2,720,000
Balaklala	.....	.....	.....
Copper Queen	7,088,862	6,373,062	7,006,097
Calumet & Ariz	3,656,000	4,394,000	4,650,000
Detroit	1,732,692	1,590,357	2,080,100
East Butte	841,200	.....	.....
Mammoth	.....	1,598,082	.....
Nevada Con	5,307,400	5,258,582	.....
Old Dominion	1,907,000	2,114,000	1,982,000
Shannon	1,098,000	1,150,000	1,442,560
South Utah	158,661	254,462	269,546
United Verde*	3,000,000	3,000,000	.....
Utah Copper Co	7,908,685	7,555,407	.....
Lake Superior*	19,800,000	17,060,000	19,000,000
Non-rep. mines*	12,851,700	16,800,000	.....
Total production	91,673,500	.....	.....
Imports, bars, etc.	22,348,964	20,999,078	.....
Total blister	114,022,464	.....	.....
Imp. in ore & matte	4,744,912	4,205,940	.....
Total	119,767,376	.....	.....
Brit. Col. Cos.:			
British Col. Copper	816,676	854,12[illegible]	.....
Granby	858,733	1,228,84[illegible]	.....
Mexican Cos.:			
Boleo	2,315,040	1,973,680	2,149028,
Cananea	3,462,000	3,994,000	.....
Moctezuma	2,071,960	2,340,404	2,263,707
Other Foreign:			
Cape Cop., S. Africa	.....	.....	.....
Spassky, Russia	542,080	672,000	.....
Exports from:			
Chile	3,960,000	7,168,000	4,032,000
Australia	7,168,000	7,056,000	7,392,000

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER

Month	United States Product'n.	Deliveries, Domestic.	Deliveries for Export
VIII, 1910	127,803,618	67,731,271	61,831,780
IX	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,936,364	69,855,660

VISIBLE STOCKS.

	United States.	Europe.	Total.
IX, 1910	168,881,245	218,444,800	387,326,046
X	148,793,714	211,276,800	360,070,519
XI	139,261,914	198,060,800	337,322,711
XII	130,389,069	193,200,000	323,589,095
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

some of the Porcupine issues retain activity and strength. Rhode Island Coal has been in fair demand. The banking house of Hayden, Stone & Co. has loaned the company $100,000 on mortgage.

Assessments

Company	Delinq	Sale	Amt
Argenta, Ida	Sept. 10	Oct. 10	$0.001
Best & Belcher, Nev	Sept. 4	Sept. 25	0.05
Black Horse, Ida	Sept. 18	Oct. 19	0.01
Buffalo, Ida	Sept. 5	Oct. 5	0.002½
Calumet, Ida	Aug. 15	Sept. 15	0.001
Challenge, Nev	Aug. 17	Sept. 7	0.05
Columbus Ext., Utah	Sept. 4	Sept. 27	0.05
Con. Virginia, Nev.	Sept. 9	Sept. 13	0.25
Copper King, Ida	Aug. 15	Sept. 16	0.01
Douglas, Ltd., Ida	Aug. 25	Sept. 26	0.002
Exchequer, Nev	Sept. 19	Oct. 10	0.05
Hale & Norcross, Nev	Aug. 30	Sept. 20	0.05
New York-Bonanza, Utah	Sept. 8		0.02
Overman, Nev	Sept. 12	Oct. 3	0.05
Pretoria, Ida	Aug. 15	Sept. 15	0.000½
Savage, Nev	Aug. 22	Sept. 12	0.10
Seven Troughs Mon., Utah	Aug. 12	Sept. 6	0.002½
Spider, Utah	Aug. 15	Sept. 15	0.002½
Springfield, Ida	Sept. 2	Oct. 2	0.000½
Tintic Standard, Utah	Sept. 9	Oct. 9	0.00
Torino, Ida	Aug. 15	Sept. 15	0.00
Utah Ideal, Utah	Sept. 6	Oct. 8	0.001½
Utah United Copper, Utah	June 24		0.01½
Verde May, Ida	Sept. 6	Sept. 21	0.000½
Victoria, Mich	Aug. 21		1.00
Western Monitor, Utah	Sept. 11	Oct. 12	0.002½

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	53.043	24.166	24.651	24.486
July	51.043	54.150	52.630	23.519	25.034	24.286
August	51.125	52.912	52.171	23.588	24.428	24.082
September	51.440	53.295		23.743	24.567	
October	50.923	55.490		23.502	25.596	
November	50.703	55.635		23.351	25.680	
December	52.226	54.428		24.030	25.160	
Total	51.502	53.486		23.706	24.670	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.368
July	12.215	12.463	12.570	12.720	54.194	56.670
August	12.490	12.405	12.715	12.634	55.733	56.264
September	12.379		12.668		55.207	
October	12.553		12.788		56.722	
November	12.742		12.914		57.634	
December	12.581		12.863		56.769	
Year	12.738		13.039		57.054	

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42.400
February	32.920	41.614	August	33.972	43.319
March	32.403	40.157	September	34.982	
April	32.976	42.185	October	36.190	
May	33.125	43.115	November	36.547	
June	32.769	44.606	December	38.199	
			Av. Year	34.123	

Prices are in cents per pound.

LEAD

Mohth	New York		St. Louis		London	
	1910.	1911	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	4.435	4.207	4.292	12.688	13.260
July	4.404	4.499	4.291	4.397	12.531	13.530
August	4.400	4.500	4.290	4.406	12.513	14.026
September	4.400		4.289		12.582	
October	4.400		4.271		13.091	
November	4.442		4.314		13.217	
December	4.500		4.363		13.197	
Year	4.446		4.312		12.920	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	5.520	4.978	5.370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August	5.279	5.953	5.129	5.803	22.800	26.801
September	5.514		5.364		23.165	
October	5.628		5.478		23.900	
November	5.976		5.826		24.083	
December	5.624		5.474		24.019	
Year	5.520		5.370		23.050	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG.

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	15.90	15.60	14.06	15.53	14.56
July	16.40	15.90	15.40	14.03	15.40	14.53
August	16.09	15.90	14.89	14.00	15.16	14.47
September	15.92		14.73		14.93	
October	15.90		14.05		14.88	
November	15.84		14.26		14.78	
December	15.90		14.15		14.65	
Year	$17.10		$15.65		$15.83	

STOCK QUOTATIONS

COLO. SPRINGS Sept. 19

Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con.	.01½
C. K. & N.	.13
Doctor Jack Pot	.05½
Elkton Con.	.60
El Paso	.52
Findlay	.06
Gold Dollar	.14
Gold Sovereign	.02
Isabella	.08½
Jack Pot	.05½
Jennie Sample	.05½
Lexington	‡ .01
Moon Anchor	‡ .01½
Old Gold	.03½
Mary McKinney	.43
Pharmacist	.01½
Portland	.96
Vindicator	.71
Work	.01

SALT LAKE Sept. 19

Name of Comp.	Bid.
Beck Tunnel	.11½
Black Jack	.09½
Carisa	‡.15
Cedar Talisman	.03½
Colorado Mining	.28
Columbus Con	.30
Daly Judge	‡4.12½
Grand Central	1.17½
Iron Blossom	.94
Little Bell	‡.40
Lower Mammoth	.01¾
Mason Valley	7.00
May Day	.11
Nevada Hills	2.90
New York	‡.05¾
Prince Con	.62
Silver King Coal'n	2.10
Sioux Con	.17½
Uncle Sam	.33
Yankee	‡ 15½

TORONTO Sept. 19

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	5.95	Pearl Lake	.42
Hudson Bay	75.00	Porcu. Gold	.41
Temiskaming	.39½	Porcu. Tisdale	.05½
Wettlaufer-Lor	.85	Preston E. D	.24
Apex	.12½	West Dome	.95
Central	2.87½	Standard	.02
Dobie	1.35	Foley O'Brien	.95
Dome Exten	.68½	Rea	3.30
Hollinger	12.30	Coronation	.03½
Imperial	10½	Swastika	.35½

SAN FRANCISCO Sept. 19

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.02	Belmont	6.47½
Belcher	.40	Jim Butler	.24
Best & Belcher	.17	MacNamara	.18
Caledonia	.32	Midway	.28
Challenge Con	.15	Mont.-Tonopah	.75
Chollar	.13	North Star	.22
Confidence	.50	West End Con	.59
Con. Virginia	.83	Atlanta	.16
Crown Point	.70	Booth	.08
Gould & Curry	.06	C.O.D. Con	.08
Hale & Norcross	.21	Comb. Frac	.08
Mexican	3.55	Jumbo Extension	.24
Occidental	.50	Oro	.05
Ophir	1.70	Silver Pick	.06
Overman	.30	St. Ives	.30
Potosi	.17	Tramps Con	.02
Savage	.24	Argonaut	2.25
Sierra Nevada	.33	Bunker Hill	‡6.50
Union Con	1.17½	Cent. Eureka	‡1.00
Yellow Jacket	.40	So. Eureka	6.00

N. Y. EXCH. Sept. 19

Name of Comp.	Clg.
Amalgamated	54
Am. Agri. Chem.	51
Am.Sm.&Ref.,com	66⅞
Am. Sm.& Ref., pf.	102⅛
Anaconda	33⅝
Batopilas Min	1⅜
BethlehemSteel pf	60⅝
Chino	18⅝
Comstock Tunnel	‡.20
Federal M.& S., pf.	49
Goldfield Con	5¾
Great Nor., ore ctf.	45¾
Homestake	82½
Miami Copper	18
Nat'nalLead,com.	49
National Lead, pf.	106
Nev. Consol	16⅞
Pittsburg Coal, pf.	80
Ray Con	13⅛
Republic I&S,com	23
Republic I & S, pf.	87⅞
SlossSheffi'd,com.	37
Sloss Sheffield, pf.	112
Tennessee Copper	32⅜
Utah Copper	41½
U. S. Steel, com.	65
U. S. Steel, pf.	113⅞
Va. Car. Chem	51¼

N. Y. CURB Sept. 19

Name of Comp.	Clg.
Barnes King	‡.15
Braden Copper	4½
B. C. Copper	4
Buffalo Mines	1.60
Butte & Vipond	.53
Butte Coalition	15⅛
Cobalt Central	.00½
Con. Ariz. Sm.	⅜
Davis-Daly	⅛
Ely Con	⅜
Florence	1¼
Giroux	3⅛
Greene Cananea	6
Greenwater	06
Guanajuato	‡3¾
Guerrero	1¼
Guggen. Exp	185
Inspiration	6⅜
Internat. S. & R.	‡124
Kerr Lake	3¾
La Rose	4⅞
McKinley-Dar-Sa.	1⅞
Min. Co. of A. new	5¼
Moneta Porc	.12
Nev. Utah M. & S.	⅝
New Baltic	4¼
Nipissing Mines	8
Ohio Copper	1⅜
Pacific Sm. & M.	¼
Precious Metals	‡1⅜
Ray Central	1⅞
Red Warrior	‡1½
South Utah M. & S.	¾
Standard Oil (Old)	630
Stand'd Oil of N.J.	340
Stand'd Oil Subs.	325
Stewart	.82
Tonopah	6⅛
Tonopah Ex	.92
Tri-Bullion	⅝
Tularosa	⅛
Union Mines	¾
Yukon Gold	3½

LONDON Sept. 20

Name of Com.	Clg.
Camp Bird	£1 7s 4½d
Dolores	1 10 0
El Oro	1 3 0
Esperanza	1 12 9
Mexico Mines	6 17 6
Oroville	0 5 7½
Stratton'sInd.	0 2 0
Tomboy	0 17 6

BOSTON EXCH. Sept. 19

Name of Comp.	Clg.
Adventure	4¼
Algomah	3½
Allouez	23½
Am. Zinc	22⅜
Arcadian	2¼
Arizona Com	.90
Atlantic	‡6
Bonanza	.50
Boston & Corbin	4⅛
Butte & Balak	4¼
Calumet & Ariz	49⅛
Calumet & Hecla	390
Centennial	8
Con. Mercur	.04
Copper Range	52
Daly-West	5⅛
East Butte	10
Franklin	6⅛
Granby	31
Hancock	18½
Hedley Gold	14
Helvetia	¾
Indiana	6¾
Isle Royale	12
Keweenaw	2¾
Lake	24¾
La Salle	3¼
Mass	5⅜
Michigan	1½
Mohawk	39
New Arcadian	‡2¼
North Butte	23¼
North Lake	4⅞
Ojibway	4¼
Old Dominion	37
Osceola	85
Parrot	9
Quincy	63
Shannon	8
Shattuck-Ariz	15½
Superior	24
Superior & Bost.	2⅝
Tamarack	21
Trinity	3
Tuolumne	3¾
U. S. Smelting	32⅛
U. S. Smelt'g, pf.	46¾
Utah Apex	2
Utah Con	12
Victoria	2
Winona	5
Wolverine	96
Wyandot	.90

BOSTON CURB Sept. 19

Name of Comp.	Last
Ahmeek	155
Bingham Mines	⅜
Boston Ely	1⅛
Boswycocolo	11½
Cactus	.10
Calaveras	1⅛
United Verde Ext.	.43
Chief Cons	.73
Corbin	.99
Cortez	1⅛
Crown Reserve	2⅛
First Nat. Cop	1⅛
Live Oak	18½
Majestic	.35
Mazatan	.90
Nat'l Mine & Ex.	.10
Nevada-Douglas	2⅜
Oneco	1½
Raven Copper	.29
Rhode IslandCoal	1⅞
San Antonio	3⅜
South Lake	4½
Tretheway	.65
United Zinc, pfd.	‡2
Vulture	5½
Yuma	‡.02

‡Last quotation.